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## CULTIVATED RELAXATION FOR THE ELIMINATION OF "NERVOUS BREAKDOWNS" \*

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From time to time in the course of medical affairs, it can be profitable for us to pause in our presentation and consideration of scientific data in order to see what we can do to turn them to practical account. Such is our purpose in this paper in a certain field of nervous disorders which are of common occurrence, particularly during war.

By nervous breakdowns is commonly meant the loss of the subject's capacity to carry on his business and social affairs, because of emotional disturbance, although his nervous system remains intact in structure. The term is employed more often by laymen than by physicians, who argue that it does not apply if there is a so-called underlying organic disease, such as infection, heart inadequacy, diabetes or cancer. I am not sure that the doctors are always right in this argument for several reasons:

1. The nervous system often plays an important part in the breakdown even when there is serious organic disease. Accordingly there is reason to believe that many persons could more readily be reclaimed to efficiency, if not to normalcy, if the doctors understood better how to apply neurophysiologic methods. In point are some of the breakdowns ascribed to chronic heart disease, when the patient has never been taught to engineer his organism with a view to avoiding unnecessary excitement and worry, especially about his condition. Included also are many instances of vascular hypertension marked by headaches, dizziness and other symptoms so severe as to lead him to give up his normal pursuits. Most doctors can testify from their experience that many of the disabilities result from overconcern in such patients regarding their symptoms, but it is seldom realized to what extent those disabilities arise from the inefficient manner in which the patient conducts his organism under the burden of the pathologic condition from which he suffers. In disabilities due to organic derangement, there is a way for the patient to carry on much better than he commonly does, if he and the doctor know how to manage. According to this view, breakdown due to organic heart disturbances might often be delayed or averted altogether if the patient learned how to manage his neuromuscular system effectively under certain limitations. To this extent, there seems to be some justification for the use of the familiar term, "nervous breakdown."

2. In many instances of nervous breakdown, foci of infection (in the teeth, tonsils or elsewhere) are discovered and eliminated, and if the patient recovers from his symptoms of nervousness, the doctor sometimes jumps to the conclusion that the infection was the cause of the breakdown. He should look before he leaps, heeding the warning of A. J. Carlson and others that an event (such as recovery) is not necessarily caused by another which preceded it (a particular measure of treatment). The fallacy is familiar: *post hoc ergo propter hoc*. It is not surprising that infection should be found in patients, for this is very common, whether they are nervous or not. When an operative or medical measure is employed to relieve infection, rest is generally employed as well; under such combined treatment it often becomes impossible to say how much of the end result derives from the rest and how much from the operative or specific medical

\* Read before the Twentieth Annual Session of the American Congress of Physical Therapy, Washington, D.C., September 4, 1941.

procedures. In addition, as a rule the doctor reassures his nervous patient, and his words and manner may have an effect comparable to the influences engaged by the Christian Science practitioner or even by the hypnotist. That the doctor can exert a personal influence on the patient is undisputed and needs to be weighed in the etiologic and therapeutic comprehension of the disorder. Not realizing these facts clearly, both doctor and patient may become confused. Too often the removal of an infection, said to be "the underlying cause," is followed by recovery which proves to be brief; but during the relapse the patient runs from doctor to doctor vainly seeking to explain his chronic nervousness by finding new infections.

If we confine our discussion to the types of breakdown which doctors generally call "nervous," various signs suggest that they probably are increasing in number during these days of war and defense programs, just as they were during the depression. Of late, I have been seeing particularly business executives and their associates, but also the rank and file of their workers in various departments. Many of them state that their daily duties and burdens have become greater than they can bear. The chief executive of one branch of one of the largest corporations said recently, "We were harassed to keep up with the demands on us for peacetime needs alone; but now, with the additional requirements for the defense program, we often lack both the men and the materials or tools; the combined effect is maddening." This man is obliged to listen to the reports of his overworked associates so as to advise and direct them in their zeal to increase production; he finds his mind overworking even during hours which should properly be devoted to leisure and to sleep. Such overstrain leads not only toward nervous hypertension but perhaps also to diminished resistance to infection.

Judging by experiences with patients, the number of breaks in dynamic business men today is serious. Large and small organizations abound with instances of men in their forties and fifties, vigorous and energetic, suddenly stricken from within and rendered of little further use to the world or to themselves. Investigation points to the overwhelming role of high nerve and muscle tension in producing these losses in business manpower. Similar losses are occurring among government executives in Washington. There is no need to recount instances: Step into any large department and you will be told of one man out and another man ailing because of the high pressure of the times. As the ambitious person feels himself failing, he tries to keep up by all the more effort, thereby creating a vicious circle of still higher tension. Many maintain a pretense of full accomplishment to themselves as well as to others; they engage in "wishful thinking" that they are well and efficient—until the break comes. For every one who breaks down, there are many others who do not fall so far as to have to give up their work, but in whom lessened efficiency becomes chronic, even if not recognized.

It is high time that we recognize these human losses to business, professional and educational life, but also that we take steps to prevent some and to meet others effectively. Thanks to progress in clinical physiology, we are now prepared for the first time in the history of medicine to recognize and to determine the severity of nervous or neuromuscular states, whether outwardly manifest or not. For recognition and measurement we now possess three types of instruments and for prevention and treatment we have now the direct approach—the immediate relaxation of the nervous state by the patient himself, carrying out the technical instructions of the physician.

When nervous breakdown is imminent or at hand, the symptoms and signs are there to read. In brief they are manifestations of severe overaction of the vegetative or cerebrospinal nervous system. There results at times a marked underaction or inhibition in the same parts, due to fatigue. Every organ in the



body can be affected; the doctor must cease to look only in the nervous system for the disorder. Since every viscus is supplied by nerves which report its action to headquarters and control its actions as well, high tension in the controlling



Fig. 1. Twelve hour film (approximately) after a barium sulfate meal. Even if there are no gastrointestinal complaints, the colon in a nervous patient is characteristically spastic. The patient, a widow aged 54, complained chiefly of symptoms of high blood pressure. The diagnosis was neuromuscular and arterial hypertension and alimentary spasticity.

nerves is bound to bring with it high tension in the viscus. Accordingly, when, for example, a person under strain has a so-called digestive upset, the doctor should be cautious before he blames the food entirely. Doubtless some of the upsets frequently encountered are really due to infected or spoiled food; but we should realize that the person who is quite relaxed does not readily suffer from digestive upsets, while the highly tense patient is more often susceptible. In my experience, based on roentgen ray examinations in our Chicago clinic over a ten year period, excessive tenseness in the gastrointestinal tract is always present during highly nervous states. Included are not alone the spastic esophagus and the "irritable colon," but later sequelae, including the "peptic ulcer." Often it is the digestive complaint that brings the patient to the doctor (figs. 1, 2, 3 and 4).

Peptic ulcer is seen in the disabled particularly often, and its incidence is generally ascribed to nervousness. Perhaps to some extent I am responsible for this view, since in 1929, when a distant focus of infection was commonly presumed to be the cause, I suggested that physicians investigate whether the symptoms of this disease would not subside under a regimen of relaxation. If respon-

sible, I wish that I had been equally successful in influencing opinion on certain other matters when I have presented evidence based on systematic investigation, rather than mere clinical impression, for that nervousness is the cause of peptic ulcer is still suspected rather than proved. Sparks of evidence appear from other sources as this article goes to press.<sup>1, 2</sup>



Fig. 2. — To be compared with figure 1 as a control test is this photograph of a fairly normal-appearing colon. The patient is an alert business woman aged 38, not particularly nervous and with no complaints except that her marriage has been almost sterile. Note that the colon resembles normal models in textbooks of anatomy.

In other instances of breakdowns, the heart seems startlingly affected. There is palpitation, even precordial pain. The patient becomes fearful, especially if he experiences nausea, dizziness, weakness or fainting. An electrocardiogram may disclose a normal reading or may suggest some form of altered conduction or of muscular change (figs. 5 and 6). In many instances in which pains occur in the chest, suggestive of angina, the electrocardiogram as well as other means fail to

make sure whether or not the organ is impaired or whether it may become so.

In the patients with functional heart disease attended by nervous symptoms whom I have examined under the roentgen ray, certain signs of esophagospasms are characteristic.<sup>3</sup> The passage of a bolus of thick barium sulfate paste is greatly delayed. Substernal pain and pressure can result from the spasm, and

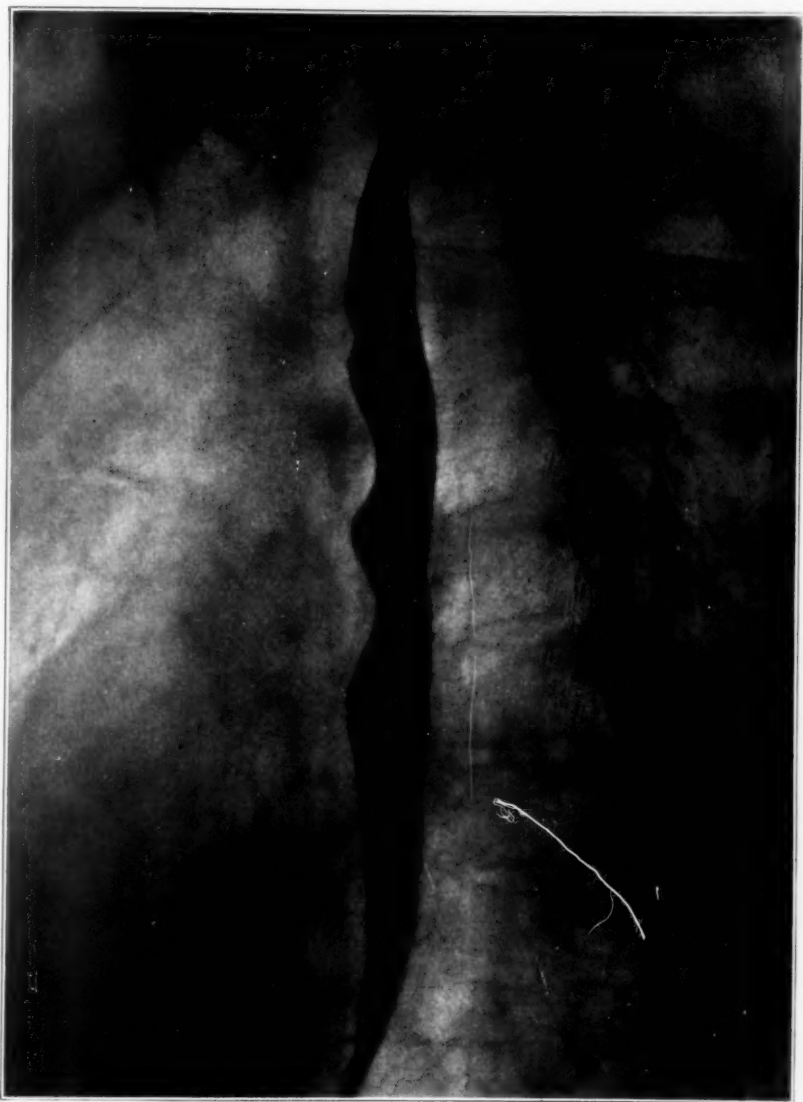


Fig. 3. — The esophagus in a nervous patient is characteristically spastic in tendency. This view was taken five minutes after one big swallow of a barium sulfate paste, further swallowing being avoided. The diagnosis was nervous hypertension, mucous colitis and spastic esophagus.

the doctor may mistake them for anginal pains. But true angina also is accompanied by general nervousness and by a certain degree of esophagospasm with its attendant symptoms.

Whether the patient suffers from functional or organic heart disease, his spells or attacks are marked by generalized nervous states. These states can be measured, and they can be treated directly. The possibility of such treatment may render the prognosis more favorable.

High blood pressure, constant or intermittent, may be the sign which worries the patient and his doctor most.<sup>4</sup> In some cases the diastolic pressure is normal, while in the more serious instances it may be high, either intermittently or fairly constantly. Renal function tests may or may not show insufficiency.

According to the history of medicine, when maladies of a particular type are on the increase, we can expect that measures will be found to meet them appropriately. Recently we have witnessed the addition of insulin, of the vitamins and of the sulfonamide compounds to the medical armamentarium. By measures no less effective in their field, I believe that we can learn to meet the blitzkrieg of nervous breakdowns. By way of a personal touch, I might relate how I happened to become interested in the matter.

Many years ago (1908), when William James, Hugo Muensterberg and Josiah Royce were still in the Harvard department of psychology which they had made famous, I had the good fortune of being a graduate student there, while I had at the same time the opportunity to work with Walter Cannon in physiology. There I began a study of the emotional phases of nervousness, particularly the

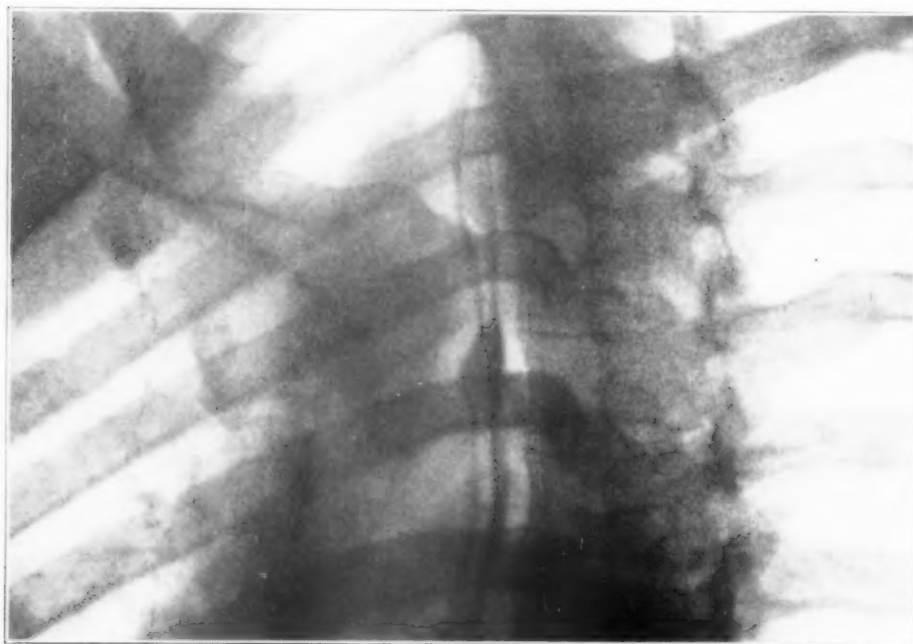


Fig. 4.—In contrast with figure 3, the esophagus in a relatively non-nervous patient shows little retention of paste after five minutes. A little may cling to the walls. The patient is the same as in figure 2.

measurement of certain of their effects. Reluctantly my attention was turned away from the psychologic but toward the physiologic aspects of the phenomena under study. I found that regardless of the prior emotional state of the subject, what was called "nervousness" (within the limits of the investigation) disappeared if he relaxed his skeletal muscles sufficiently.

However, the psychologic aspects of the study were not to be ignored. When the subject was excited, his muscles were tense and then he could note certain sensations (i. e. from the muscle spindles). Sensations can be regarded as signals to the organism, and those which inform him regarding states of his body are known to psychologists as proprioceptive sensations. I found that what laymen call the feeling of nervousness consists of certain proprioceptive sensations, particularly the muscular type. If these sensations diminished toward the vanishing

point, the subject (whether lying or sitting) went to sleep. If they diminished moderately, he became nervously more quiet.

An account of these investigations was published as a thesis for the doctorate in 1910,<sup>5</sup> but I reported on the subject in earlier years in Muensterberg's seminar. I. H. Coriat was there and in later years wrote about relaxation leading to sleep, but he used the capillary electrometer — an instrument not adapted to the subject of his investigation — and accordingly made no advance in the experimental development of the field, although I have always been grateful to him for his interest. On the other hand, several investigators many years there-

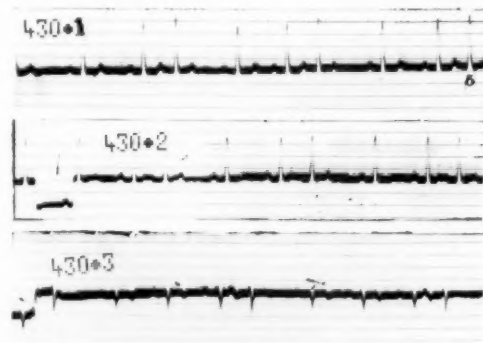


Fig. 5. — This electrocardiogram of a highly nervous man aged 28, with various signs of early heart disease, illustrates that acute neuromuscular hypertension can affect the heart function. Lead I, appearing below, shows pulsus bigeminus, the RR interval, normally 0.81 second, giving a rate of 72. The PR interval is 0.22 second. Every third beat is an auricular extrasystole. The P wave is broad, with indication of notching in all leads. There is left ventricular preponderance. T<sub>2</sub> is inverted.

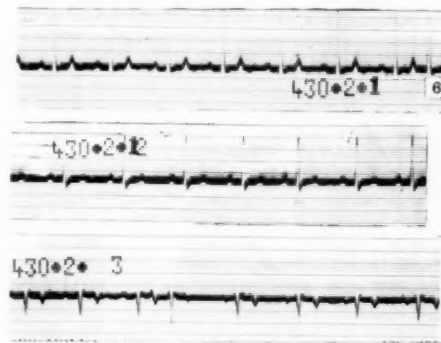


Fig. 6. — An electrocardiogram of the same patient as in figure 5, about two and one-half hours later, after his emotional excitement had evidently disappeared, showed a return to regular rhythm with the exception of an occasional auricular extrasystole, occurring not oftener than about twice a minute. The RR interval is 0.86 second, giving a rate of 69. The PR interval is 0.22 second. The P wave continues to be notched, and there is notching of S<sub>4</sub>.

The return to almost regular rhythm, after about three hours of the irregular type shown in the first record, was first noted on palpation of the pulse after about fifteen minutes of progressive relaxation. After a total period of about forty-five minutes of general relaxation, the patient was shown how to be relatively relaxed and was instructed to maintain this state while returning in a taxicab to the hospital for the second electrocardiogram. Twenty years have elapsed, during which time the highly hypochondriac patient has tried to keep relaxed. There has been no recurrence of cardiac irregularity such as appears in figure 6, and no nervous breakdown, even during a period of rheumatic endocarditis and another of syphilitic infection.

after ascribed to him the initial suggestion of the relationship between relaxation and sleep, and to keep the record clear it has seemed worth while to relate how things really happened.

The physiologic conception of nervousness derived from the series of investigations here related is simple. A word or two might well be said here in outline of previous conceptions which had dominated medical thought on the subject. In the middle half of the nineteenth century, including the days of Johannes Müller, "nervousness" was identified with irritability, but later this view was challenged

when increasing clinical experience emphasized that nervous patients showed signs not only of increased excitability but of depression, that is, of inhibition. Weakening of this view in the last decades of the century left the field more or less open for the advent of the conception of nervousness as "irritable weakness," or "neurasthenia," advanced by Beard, which at first was rejected in Germany but later was accepted the world over for many years.

According to this view, some persons are born with a weak nervous system or one which tends to become weak under the stress of circumstances. In recent years we have had to abandon this view almost completely, because as physiologic investigations have gained in precision, replacing the merely clinical studies of previous decades, little evidence has appeared that there is a common disease deriving from weakness of the nervous system, or neurasthenia, in the sense of Beard.

As recently as 1920, when I hoped to help establish a view of clinical nervousness harmonious with the increasing knowledge resulting from the countless investigations of physiologists and pharmacologists, the task appeared almost hopeless. For example, I recall a symposium at the University of Chicago a few years later when a neurologist famed for his understanding of organic diseases discoursed on the subject of sleep, asserting that insomnia was the result of fear. A. J. Carlson arose to say that he had never known fear and was certain that the insomnia which he at times personally experienced must have resulted from some other cause. N. Kleitmann likewise spoke on the physiologic basis of sleep, for, so far as I know, he has always, even in his student days, agreed with my view that sleep occurs if and when relaxation becomes sufficiently advanced. On the other hand, many of the neurologists who made a habit of giving sedatives for insomnia asserted firmly that relaxation was the same as what they called "mental suggestion." After these many years, it seems safe to say that some of the opposition have been won over and now realize that by relaxation is meant not "suggestion" but something very different, namely the lengthening of muscle fibers and the inactivity of nerves.

This brings me to the fact that thanks to the generous aid of the Bell Telephone Laboratories I was able to measure nervousness as well as muscle tonus not just for laboratory purposes but also to meet practical needs in the clinic. I wish that this were more widely realized among doctors, for it can lead to a sound understanding of the nervous side of human ills as a basis for treatment.

Wires attached to electrodes either actually in muscles or nerves or on the skin lead to electrical equipment one thousand times as sensitive as the electrocardiograph. Muscle and nerve impulses (action potentials) are measured (within a limited frequency range) in terms of microvolts (millionths of a volt). Photographs can be secured showing marked vibrations if the part is tense, but the string is quiet if the part is relaxed.<sup>6</sup> For clinical purposes, photography can now be omitted; an apparatus has been perfected which adds up and averages the potentials. The operator reads off the values on an illuminated dial, allows for certain constant errors, uses a slide rule and at the end of the test period has everything measured and ready for graphing.<sup>7</sup>

Hansson, Troedsson and Schwarzkopf<sup>8</sup> dwelt on the usefulness of their studies, in which they followed the well known methods of photography, but they related freely certain difficulties which they had encountered, lessening the value of the method. The difficulties which they mentioned had to be met in our laboratory some ten years ago. Unfortunately, the literature which describes them has been overlooked. To differentiate partial and complete paralysis from normal states in muscles requires a voltage sensitivity greater than could be furnished by the instruments employed by these investigators.

When voltages on the order of one microvolt or less are measured, it becomes possible to make direct measurements on what we call "mental activities."



These are functions which do not belong exclusively to the brain (as most psychologists and others believed prior to these studies). When a person imagines, recalls, reflects or engages in any emotion, if investigated under controlled conditions, it is demonstrable that skeletal muscles take part, in a pattern which varies minutely with each individual mental act. We no longer cling to the old belief that these muscles "merely express what is going on in the mind." On the contrary, all our evidence indicates clearly that mental activities consist (in part) of physical acts, but acts which usually are microscopic and abridged as compared with what people ordinarily call physical acts. When one raises his hand to stroke back his hair, he engages in an overt physical act; but if he closes his eyes and merely imagines that he is doing this, his act will be physical also. The same arm will move as if to brush back the hair, as can be measured in most subjects; or else the eyes will turn up toward the hair, in which event the physical act is an actual turning up of the eyes; or else the act will be performed both manually and ocularly. Whichever of these three types of physical act is performed can be detected with instruments sufficiently delicate. But I wish to point out that unless one acts physically (however minute his replica of the ordinary experience of brushing back his hair), he will not imagine or recall nor reflect or experience emotion, for action limited to regions within the brain does not make possible mental activity.<sup>9</sup>

It is found that thinking about abstract matters consists of neuromuscular acts no less than if the matter is concrete.

I hope that some readers will become sufficiently interested to look further into the various physiologic and psychologic matters which I have outlined. It may repay the effort, since by these means it has been possible to measure for the first time in history the physiologic components (aside from the brain) not only of nervousness or tenseness in man and in animals but also of mental activities in man. Furthermore, mental states no longer will appear "intangible" to the informed physician, as they have in past times, since a new and definite understanding can now be attached to them. We know what constitutes mental activities on the physiologic side in a way which we did not grasp previously. This gives us a handle of use in psychiatry; according to my experience, the mental sides of the nervous breakdown can best be understood and treated in terms of known physiologic components.<sup>10</sup> But the matter is of no less moment to the general practitioner and to the specialist in various fields, for according to modern conception, the patient should be treated as an integrated organism, from the "mental" as well as the "physical" viewpoint.<sup>11</sup>

Patients in a highly nervous state are distinguished by the number and the variety of their complaints. Interns call them "neuros" and ascribe their symptoms mostly to their overworked imaginations. If there is an element of truth in this view, it can nevertheless present a false picture of the nervous person as a whole. Of Simonides it was said that he was the ablest of liars up to his day (in these times Hitler might easily rival him), because he was always sure to incorporate some truth in his falsehoods. When interns or the older doctors who instruct them look on the nervous person as suffering exclusively from a mirage with no peripheral or organic basis, there is of course no intentional prevarication, but unintentionally they distort the medical picture nevertheless. The nervous patient always shows his condition in changed functions notable particularly in the skeletal musculature, as well as in the smooth musculature of the gastrointestinal and the circulatory systems. In most instances his symptoms can be traced variably in one part or another of those systems. As older views of neurosis become outmoded, we must learn to use our eyes, ears and other senses, aided by the newer diagnostic instruments, to detect the phenomena which continue for the most part to be overlooked in current prac-

tice, even in the sanatoriums which house so many of the nervously broken down.

When a patient becomes relaxed in the technical sense, if his organs are fundamentally sound or not too diseased, he can continue at his daily work and affairs. As a rule nothing is gained by removing him from his accustomed employment. Not merely does the enforced vacation turn him all the more to thinking about his own personal difficulties in many instances; but later on, resuming work, after enforced rest, may prove a great hardship; he must face again the former difficulties, whereupon the old symptoms are likely to return after the manner of conditioned reflexes. For the patient it would appear far better to continue at his work without interruption, if at the same time he is instructed to relax by technical methods.

It is not alone good medicine, but also good pedagogy, to teach the patient not to run away but to learn to stand his ground. It differs from answering his querulous questions with the reassurances which he craves. There should be little or no need for sedatives in most instances if the doctor is expert in training his patients to keep relaxed while at their work and play ("differential relaxation").

What about the views of those psychiatrists who insist that every nervous breakdown is brought about because the patient unconsciously tries to escape from his difficulties? What about their claim that only by psychoanalysis can we penetrate to the "hidden cause" of any nervous breakdown, enabling us to remove the cause and to cure the patient? There is no time to discuss these claims adequately tonight. I have always found them fascinating, for in my opinion Freud was one of the greatest speculative geniuses of his age, and my early training in philosophy led me to respect intelligent speculation as one of the means underlying the progress of knowledge. But speculation is far removed from science, and I know of no really scientific proof that nervous breakdowns result from unconscious wish fulfillments. Evidence of a sort is provided from analyses of dreams and of symptoms by the method of free association, but without control tests the analyst can impart his own views and interpretations to the patient, so that it is not surprising that similar views and interpretations are advanced by the patient after he becomes accustomed to the procedure. I do not suggest or believe that the analysts are wrong altogether in their interpretations, for I have admired and even envied the imagination which they often exhibit. They have discovered some important truths, but their methods, not being scientific, have up to date failed to distinguish between the chaff and the grain.

Whatever their achievements, I cannot follow them when they insist that all nervousness derives from unconscious wishes (which are repressed). Examples to the contrary in common experiences are countless. I have seen breakdowns follow the development of organic heart disease, when the patient was fearful about his health, even that he might die. In such instances, there is no need to hypothecate some unconscious sex impulse to explain the nervous state nor to assume that the patient suffers a conflict with an unconscious wish for death. I have witnessed breakdowns which followed automobile and other accidents and catastrophies or the loss by death of a parent, a child, a beloved relative or a friend. I have noted nervous symptoms apparently occasioned by loss of station or of fortune as well as by the daily drudge of concern about finances, and I have observed that most persons, including analysts, when placed under such trying circumstances, tend to become nervous. Indeed, under trying circumstances, analysts have not seemed to be less nervous than average persons of other professions, but perhaps more.

Instances of nervousness manifestly deriving from current incidents are too numerous in everyday life to be listed. Many a housewife today, unable in war-

time to secure the help she needs in her household, is overworked and over-worried, particularly if she has responsibilities with children. To assume that this should be ascribed to sex difficulties is to multiply causes unnecessarily.

Let me add just one more instance to illustrate that it is absurd to generalize that all nervous states result from the unconscious. In the laboratory, the investigator can easily make the average person very nervous, for example, by administering painful electric shocks, by firing a gun nearby or by exposing him to extremes of heat and cold. He can accomplish this also by administering caffeine in great excess and various other stimulants. Obviously these examples dispose of the claim made by some analysts that the cause of nervous states always lies in the unconscious.

We return to the physiologic view of nervous states, which all physicians must respect, just as they must know anatomy. This view can be stated in universal terms: It is impossible for the patient to be nervous in any part of his body while that part is sufficiently relaxed. If one chooses, one can regard this as the fundamental law of neuropsychiatry, as fundamental as is Newton's first law for mechanics. If a cure is effected or if the patient becomes worse, whatever the remedy or whatever the source of aggravation of symptoms, the results as well as the progress or regression of the case can be stated in terms of neuromuscular tension and relaxation.

If so, we have attained not merely an empiric but what is also a rational therapy of nervous breakdowns. From a practical point of view I believe that doctors can learn to use it most effectively if they will devote to the subject the years of training which it requires.

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# ELECTRIC SHOCK TREATMENT AND PREVENTION OF PSYCHOSES \*

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About 1934, treatment of mental disease gained important new impetus when two radical methods of treatment were introduced to supersede the usual custodial care. Long observation had established the fact that mental disorder sometimes improved after a severe shock. Both new methods consisted of inducing shock with the specific purpose of alleviating a pathologic state of mind.

Dr. Lazlo von Meduna, of Budapest, discovered that it was possible to establish an epileptic convulsion by using a solution of camphor in oil administered intravenously and also by the intravenous injection of aqueous solutions of metrazol.<sup>1</sup> According to his conception, a biologic antagonism exists between schizophrenia and epilepsy.<sup>2</sup> By this method, in some cases of schizophrenia, certain symptoms cleared up. Unfortunately, as the situation is understood today, patients later relapsed to their previous conditions. The improvements were only temporary.

The second type of treatment, that of insulin shock, resulted from Sakel's accidental discovery<sup>3</sup> that the large doses of insulin injected in a diabetic schizophrenic patient for his physical ailment led to the improvement of his mental condition when he came out of his coma.

With wider experience, however, and a larger number of cases on which to base conclusions, both methods were discovered to have unfavorable components. Neuropathologic changes found after insulin coma and in a lesser degree after metrazol convulsions (Accornero<sup>4</sup>), included presence of hemorrhages, disappearance of Nissl's granules and other cellular changes of a more chronic nature, such as alterations of the cytoplasm, glial alterations and dilatation of vessels with changes of endothelium. These changes occurred in the cortices of two groups of dogs, of which one group was killed by the administration of insulin and the other by other means after thirty insulin comas.

The use of drugs had other disadvantages, including the fear of patient at repetition of the treatment; psychomotor excitement, with sequels such as confusion, irritability and vomiting; transient loss of memory; mechanical injuries, such as fractures and dislocations (Stalker,<sup>5</sup> McGuinness<sup>6</sup>); cardiac complications; auricular fibrillation, and heart block (Dick and McAdam<sup>7</sup>).

In addition to these disadvantages, chemical injection was difficult when the patient had veins of poor caliber, thrombosis of the veins or inaccessible veins due to obesity.

For some years in Genoa, Prof. U. Cerletti, in studying experimentally the problems of epilepsy, had produced epileptic fits in animals, most of them dogs, by using 125 volts of 50 cycle alternating current through the application of electrodes in the mouth and rectum of the animals. The technic and the physiopathologic changes were published by one of his pupils, Chiauzzi.<sup>8</sup>

When early reports of the shock treatment by Sakel and von Meduna

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appeared, it occurred to Cerletti that epileptic shock might also be induced in human beings by means of electric current. His assistant, L. Bini, built an electrical apparatus to regulate the strength of the current and the time of passage. A 50 cycle alternating current from the mains was used. A clamp held large electrodes on the temples of the patient and the voltage varied from 80 to 115.

After long experimentation on dogs and later on hogs, Cerletti and Bini gave their first electric shock to a human being, an elderly schizophrenic patient in April, 1938. They found that it produced the following effect<sup>9</sup>: The patient's body showed a generalized contraction. His trunk, legs, arms and hands remained in a semiflexion spasm. The face reddened, then quickly paled and then became intensely blue, and respiration stopped. There was moderate tachycardia. Thirty seconds later, the face showed a strong congestion, and the whole body passed into an agitated shock lasting for a minute or two. There was increased salivation, loss of sperm and loss of urine. This phase was followed by a general relaxation of the muscles accompanied by loud breathing. The state of unconsciousness began to disappear gradually, and the patient started to awake, look about and respond to calling. His senses, however, were still clouded and there was a tendency to go to sleep. About an hour after the shock, the patient came out of his confusion and his memory was restored.

With their apparatus, Cerletti and Bini induced about 1,000 grand mal attacks without accident, and from a therapeutic standpoint obtained results as good as those claimed for chemically induced convulsions. The two important advantages of the treatment were the extreme simplicity of the process and the entire absence of sensation for the patient.

To investigate the dangers and advantages of the electric shock method, Fleming, Golla and Walter<sup>10</sup> began a series of experiments in England in 1939. They used an apparatus which provided conditions identical with those of the Italians: alternating current from mains controlled by suitable transformers, meters and switches; large pad electrodes, and a strong salt solution.

After a series of preliminary experiments, they selected 5 psychotic patients, who were given a total of 75 shocks, 50 major and 25 minor. These were produced by between 80 and 150 volts. Cerletti had pointed out that exact calculations of head resistance were useless, for living tissues did not obey Ohm's law over a wide range of current strengths, and after passage of a strong current resistance took about a 30 per cent drop. The British workers found that head resistance varied from 450 to 1,200 ohms but remained fairly constant in one person. Current flow was about twice as great as would have been expected; 300 milliamperes was found to be the convulsion threshold.

Latency of shock lasted from a few seconds to thirty seconds and was followed by tonic and clonic phases. Convulsions lasted about forty seconds. For ten minutes afterward, the patient was inaccessible, and recovery took place in from ten to thirty minutes. In their opinion, the electrical method of shock was greatly superior to the drug method from a technical point of view, and their research confirmed the original claims of Cerletti and Bini. No attempt was made in these experiments to determine the therapeutic value of the method.

That same year, in England, Shepley and McGregor<sup>11</sup> worked to improve electric shock apparatus. Their machine consisted of two electrical circuits, independent of each other, with direct current for measuring head resistance and alternating current for the electrode voltage, which varied from 50 to 150 volts. The apparatus had a capacity up to 2,000 milliamperes,



with the time automatically limited to from 0.1 to 0.5 second. A 20 per cent sodium chloride solution was used on thin linen on the electrodes. This machine had three advantages over the Italian: the use of an electrical time switch, a ballistic method of measuring the milliampere seconds and an arrangement for compensation of fluctuation in the mains.

Shepley and McGregor considered the Italians' upper and lower limits of 80 to 115 volts too low. They themselves used a voltage that varied between 90 and 145 volts with a time setting of 0.1 to 0.2 second. The lowest voltage to induce a grand mal attack they found to be 90 volts giving 600 milliamperes through the head. Measurement of head resistance, in their opinion, offered some indication of the voltage to be applied but bore little relation to actual resistance on the shock circuit.

The results of the passing of the current consisted of the grand mal and the petit mal. The grand mal was typically epileptic, with loss of consciousness immediately, the attack taking place either at once or up to sixty seconds afterward. After a tonic contraction lasting ten seconds, the clonic stage followed, during which the face was cyanosed. There might be voidance of urine or feces. The attack lasted fifty seconds, with the patient returning to consciousness in a few minutes.

The petit mal consisted of loss of consciousness, flushing of the face, myotonic flexion of the body and possibly shallow respiration. After a petit mal, it was found that the electrodes could be applied again in two minutes, and another attempt made to produce a grand mal.

Kalinowsky in 1939,<sup>12</sup> recording his observations on electric shock therapy at Foerster's Clinic in Breslau confirmed the superiority of the English equipment. His technic required currents of 70 to 110 volts with 300 to 600 milliamperes to produce an attack. On the first attempt a minimal voltage of 60 to 70 volts was given for 0.1 second. Shocks were delivered twice a week as in von Meduna's metrazol therapy.

The value of head resistance was measured with a trial circuit or 1 milliampere and was usually found to be from 400 to 1,000 ohms. At this time Sogliana<sup>13</sup> had already discarded the preliminary measurement of head resistance and always used 110 volts, even though this often necessitated two attempts to induce a convulsion. Kalinowsky was of the opinion at this time that the control of resistance made the method more exact and should not be neglected. In his experience, patients who did not improve after five or ten shocks seldom did later. Because metrazol produced mental changes which appeared rather typically in patients treated with more than ten injections, and also because the methods of Sakel and von Meduna lost some significance when the percentage of their remissions was not confirmed by other workers, Kalinowsky considered the electric shock treatment superior to the drug method. Sogliani<sup>13</sup> gave an even higher percentage of remissions by electric shock treatment than for chemical injection, but the number of his cases was considered too few for the drawing of any conclusions at that time.

In March, 1940, Walter<sup>14</sup> reported that, while the apparent resistance range of patients was from 400 to 1,600 ohms, the true range during the passage of the current was only from 400 to 800 ohms and it was never necessary to raise the current beyond 150 volts. The difference between a convulsant and a subconvulsant dose, he discovered, was usually only about 5 volts. The convulsion lasted about 45 seconds for both tonic and clonic phases. Fleming reported<sup>15</sup> that both these phases in the electrically induced convulsion were of less intensity than similar discharges evoked by metrazol therapy. The two therapies, he pointed out, had in common the



initial jerk of the patient, but fractures, frequent in metrazol convulsions, were less common in the electrically produced variety, although in some cases spinal injury occurred.

In 1940 material on the clinical application of electric shock therapy became available. Shepley and McGregor<sup>16</sup> reported on 50 cases in which electrically induced convulsions were employed. Their apparatus was wired in two circuits with a low voltage direct current to measure head resistance and an alternating current circuit of 50 to 150 volts to apply the shock. Time ranged from 0.1 to 0.5 second. Electrodes were 38 sq. cm. in size and were covered with thin linen dipped in a 20 per cent sodium chloride. According to their findings, the time of flow was a more important factor of induction than the voltage. They were able to obtain a grand mal by using more time when an increase in voltage had proved ineffective. They advanced the view that a convulsion could be induced by high voltage in a short time or by low voltage if the time was increased. Their convulsions were obtained with an ordinary range of 100 to 120 volts with a time of 0.2 second. They noted a fall in head resistance with a repetition of shocks until a minimum of 100 to 200 ohms had been reached. With noninsulin patients, the convulsion came in from a few to 30 seconds after the shock.

Of the 50 patients treated by electric shock therapy, by far the greatest number had conditions of long standing and had failed to respond to metrazol treatment. Although the number of patients was considered too small for the drawing of any conclusions, these authors presented the following observations: Patients who failed to respond to metrazol showed no response to electric treatment, and it did not appear likely that they would. Patients who responded to metrazol and triazol also responded to electric shock, including those with katatonic schizophrenia, schizophrenic reaction of exogenous type, recurrent postpuerperal katatonic stupor (1 patient, a woman who had been pregnant twice), depressed patients, including patients with agitated melancholia, and patients with paraphrenia, recurrent mania and hysteria.

Five patients in one group, of an approximate katatonic schizophrenic type, who had formerly responded to metrazol but relapsed if treatment was withheld for two weeks, responded to electric shock treatment without fear. In a series of 200 induced grand mals, no fracture or dislocation had occurred.

Dr. Kalinowsky,<sup>17</sup> reporting on 3,000 convulsions produced in 100 patients, stated that when the duration of the psychosis was less than six months, 80 per cent showed complete recovery and 20 per cent showed much improvement. Complete recoveries decreased with increased duration of the disease. Of the patients who had had the disease one to three years, only one-third showed recovery or much improvement. Of those who had had it still longer, 50 per cent showed improvement but not complete recovery. The optimal effect in the first group was obtained after 15 complete and 4 incomplete convulsions. There was no striking difference in quality of results between the various groups of schizophrenic patients. The most surprising reaction was found in the depressed patients with manic-depressive psychosis.

Further evidence of the therapeutic value of electric shock therapy was supplied by Fox in May, 1940,<sup>18</sup> when he reported on the results of electrically produced convulsions in 7 selected patients after a series of 3 shocks a week. Of these, 5 were restored to normality and ordinary social life outside the hospital. These patients had, respectively, katatonic stupor, psychotic state of anxiety, depressive stupor, agitated melancholia (this patient, a woman, was able to return home but still showed signs of dementia) and

typical schizophrenia. Two patients showed marked improvement in behavior: a woman who appeared to have schizophrenia and a patient with hallucinated schizophrenia.

In America, electric shock therapy has been in use for some time. In 1941, Kalinowsky and Kennedy<sup>19</sup> used it to conduct valuable research into the problem of epilepsy, while Impastato and Almansì<sup>20</sup> and other psychiatric workers<sup>21</sup> had already begun to investigate its possibilities in the treatment of mental disease.

From September, 1940, to July 1, 1942, 200 inmates of Sing Sing Prison were treated by electric shock therapy in the psychiatric department of the prison.

The majority of these men showed no symptoms of psychosis. They were subject to emotional instability, paranoid and suicidal tendencies, reactive depression, episodal excitement and schizophrenic manifestations. The apparatus constructed for the therapy consisted of two circuits, direct current for measuring the resistance and alternating current to deliver the shock current, which usually ranged from 120 to 130 volts, 250 milliamperes, 0.1 second. All shocks given were of the grand mal type, with a relatively short recovery period afterward, the patients remaining in the hospital ward for about twelve hours.

The approach was primarily preventive. Prior to the introduction of this therapy, the majority of the inmates who manifested early symptoms of mental disease eventually developed major psychoses and had to be committed to state hospitals for treatment.

In the group of 200 inmates who received electric shock treatment, those with schizophrenic manifestations, 34 in all, showed no favorable reaction. After the shock there was invariably a period of agitation lasting for ten or fifteen minutes, followed by a restful sleep for half an hour to an hour. On awakening, the patient would usually announce that he felt as if he had slept soundly all night. Loss of memory was transitory. The period of relaxation seldom lasted more than eight to ten hours, after which the patient would return to the previous withdrawn, dreamlike, uncommunicative paranoid-like state for which the treatment had been instituted. In these cases, the shock therapy was discontinued after five or six shocks, often at the request of the patient, who sometimes manifested increased apprehension as the time for treatment approached.

Other groups of inmates, those manifesting early symptoms of hypomanic state (22), of depression (48), of psychopathic personality with emotional instability (51) and of psychoneurosis with reactive depression (30), showed beneficial reactions on each occasion. Psychopathic personalities with paranoid tendencies (12) and alcoholics with emotional instability (13) reacted less favorably to the treatment. Only rarely was it necessary to institute more than 5 grand mal reactions.

In some cases after a period ranging from several weeks to several months, a new course of treatment had to be undertaken to remedy the slight relapse which had occurred. Prison existence, with its frustrations and confinement, tends to develop fleeting depressions and episodes of excitement. In this extremely difficult environment, a method which is as easily available, as relatively harmless and as effective as electric shock treatment has proved itself to be a step forward in promoting adjustment and preventing the development of major psychoses in persons with precarious mental health.

Another interesting use to which electric shock treatment has been put in prison psychiatric work is that of differentiating in extremely difficult cases between a genuine psychosis and malingering. An electric shock treat-

ment breaks down the behavior pattern of the individual temporarily by disrupting the conscious arrangement of the intellectual and emotional integration. This makes it possible to investigate accurately the reaction of men who are suspected of acting out behavior patterns that simulate psychoses.

In 2 such cases, the men revealed normal reactions and gave a fairly good account of themselves. They showed no psychopathologic significance of behavior pattern, talked freely of their previous experiences and spoke of fear in connection with their immediate future. In 2 other cases, the presence of psychoses was confirmed. The men responded with slight euphoria after the convulsions, but still manifested enough pathologic material both in thought and emotion to indicate schizophrenic episodes. On the whole, the reaction of these 2 men after convulsive treatment bore some resemblance to typical release after intravenous injection of sodium amytal.

In view of the increased number of pathologic findings in the use of electric shock therapy (Smith, Hughes, Hastings and Alpers<sup>22</sup>), the last 22 patients at Sing Sing were treated by a new type of electric instrument designed by Reiter, Friedman and Wilcox to improve existing methods. The criterion for its use was the fact that a far smaller dose is needed to produce a grand mal attack than with apparatus of the kind introduced by Cerletti and Bini. This instrument delivers an interrupted direct current which is derived from a 120 volt, 60 cycle alternating current circuit. The treatment current is ordinarily 15 to 30 milliamperes and never exceeds 100 milliamperes, with a total time from 0.1 to 0.2 second.

As the total current flowing through the brain tissue is much less, the possibility of damage to the brain is greatly diminished. The physiologic effect of the shock by the Reiter instrument is similar to that by the conservative apparatus, but the cyanosis is much less during the grand mal, the force of the convulsion is less serious and the postconvulsive excitement is minimal. After use of this method, amnesia exists for a shorter period and the confused and disoriented state clears up more rapidly. As a general rule, there is a tendency for the patient to relax into a peaceful sleep, from which he awakens with a slight euphoria. Electrocardiograms made immediately before and after the shock register no variation, indicating minimal cardiac stress. The emotional effect on patients treated with this apparatus was equally beneficial, except for those manifesting schizoid features. The possibility of polarization, which at one time was considered a hazard in using direct current, is not substantiated by later knowledge of the electrodynamics of the cell.

In some cases in which shock treatment by the conservative apparatus did not give satisfactory results, therapy involving the Reiter type of current led to apparent recovery after a few shocks.

### Summary

Both the survey of the literature and this experience indicate the superiority of electric shock over the shock induced by chemical methods. Used in experiments on 200 borderline cases, in which the men showed incipient symptoms of psychosis, the electric shock proved to be of value as a preventive method to arrest the development of major psychoses.

The Reiter, Friedman and Wilcox direct current instrument appears to be just as efficient as the instrument used by Cerletti and Bini and others in inducing grand mal attacks followed by psychologic improvement. Since the total amount of current is about one-tenth of that used with other methods, the possibility of injury to the brain is materially lessened.

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# MUSCLE REHABILITATION BY ACTIVE MOTION

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While active motion in the treatment of injuries has been generally accepted, its practical use is still unsatisfactory.<sup>1,2,3,4</sup> In a great number of cases active mobilization is being ordered without adequate definition of the exact type and the exact amount of the exercises to be performed by the patient. At the present time, because it is not administered in the correct way and in the correct "doses," only a certain percentage of what could be gained by its use is being accomplished.

Often active motion is prescribed by simply advising the patient to "move as much as you can." Sometimes the patient is turned over to medical aides or gymnasts with the vague order to "start him on exercises." Some of these medical aides have learned a number of "tricks" through long experience and have acquired a certain "touch" which helps them in obtaining satisfactory results.

It is the purpose of this paper to show that it is not by "accident" or by "tricks" and "touch" that the maximum result of active mobilization can be obtained. This is achieved only by adhering to a few simple, basic rules.

Some such rules have been gradually evolved out of experience in the treatment of patients in a clinic for athletic injuries,<sup>5,6</sup> a rehabilitation clinic and the fracture division of Presbyterian Hospital in New York city. This experience has been supplemented by observation of normal athletes and by studies in physical education.

## Indications

Active motion should be used for every injured section of the locomotor system as soon as it can be employed without jeopardizing normal anatomy and without producing pain.<sup>7,8</sup>

After minor injuries, such as sprains of ligament and muscles or fractures which do not require internal or external fixation, the part should be mobilized as soon as possible without violation of the second stipulation—motion without pain.<sup>9-10-11-12-13-14-15-16</sup> The painful period after injuries can be shortened considerably and the treatment greatly accelerated by the use of anesthetics.

Active motion can be used successfully as a preparation for future operations.

Although a great number of other conditions involving joints and muscles, such as "rheumatism" and "arthritis," require treatment by active motion, these will not be especially discussed here.

## Elements of Active Motion

Before setting forth a few elementary rules, it must be pointed out that it is primarily with the function of the muscles that this paper is dealing. Healing processes in the other tissues are furthered through proper muscle rehabilitation, but always with the muscles as the means. It is the patient's muscle which can break up minor adhesions and initiate adequate circulation and which, last but not least, is itself responsible for range of motion in the afflicted joint.

Being concerned with muscles, one must remember that there are a number of different qualities inherent in every muscle, each of which responds to a different type of movement.<sup>17</sup> These qualities are:

(1) power, (2) tone, (3) elasticity and (4) coordination.

The first basic principle for all muscle rehabilitation is that a muscle will develop exactly that quality which is called for in the performance of the movement given to it, and only that quality.

The second principle is that none of the exercises should be painful to the patient, and if they do cause pain, anesthetics should be administered. Pain in any moved part will initiate a vicious circle by starting painful spasm in adjacent muscles.<sup>18</sup>

1. *Power.* — Muscle power (strength) is that quality of the muscle which enables it to lift weights and overcome resistance.

The maximum weight which can be lifted by a muscle indicates its absolute muscle power. The length of time during which this weight can be lifted consecutively indicates the endurance. This period will be longer for weight that is less than the maximum capacity.

Exercises leading to muscle power are those which require the lifting of a weight or the overcoming of resistance. The weight may be represented by the weight or the partial weight of the body region moved by the muscle. Whenever the muscle is too weak to manage the full weight of the body region, or whenever the synergists of a muscle are not able to give it adequate help, outward assistance has to be given to aid the movement. This outward assistance may come through the supporting hands of a second person, through the buoyant effect of water in which the part is immersed or through the hands of the patient himself. Resistance to the muscle may be provided by some other person or by mechanical devices.

The quantity of weight to be lifted, the resistance to the movement and the time of application must be increased gradually. It will be helpful to review an experiment made to determine the graph of muscle training.<sup>19-20</sup> By registering the maximum weight-lifting capacity of normal persons, it was found that the maximum weight that could be lifted was less on the second and third days of the experiment than on the first day. The fourth and fifth day brought a gradual increase of the weight-lifting capacity. It took the subjects of the experiment approximately six days to a week to regain the weight-lifting capacity of the first day of training. From then on a gradual gain over the initial capacity could be observed. After rising sharply from that point, the graph rose more and more slowly until it finally reached the maximum capacity. Discontinuing the daily training promptly resulted in a setback which could be prevented only by two training periods a week.

The accuracy of this experiment has been borne out by the results observed in treatment by active motion.

Power-building exercises should, therefore, begin on a gradually increasing scale so that the negative phase of the graph can be avoided. Furthermore, they should be continued regularly, and it should be kept always in mind that doing them only twice a week will barely preserve the status quo. As soon as the patient can return to his daily work, normal use will keep the muscle at the required level of efficiency. It must be emphasized, however, that unless the limb which has been treated is quite ready for normal use, there will always be a tendency on the part of the patient to favor it. In this case he will not find the necessary amount of exercise in his daily occupation, and he will lapse into a lower level of muscle power.

Overtaxing muscle power, especially in the initial stage of treatment,



will result in discomfort and pain, not only in the affected muscles but often in affiliated muscle groups.<sup>21</sup> Muscle spasm will set in or will be increased, and limitation of motion will result. This aspect of restricted active motion will be discussed in the section on elasticity.

2. *Tone*. — Tone is that quality of the muscle which enables it to sustain tension.

Exercises leading to muscle tone will require the tightening of the muscle. Such exercises are: the tightening of a muscle without producing movement (auxotonic isometric action) and the holding of a joint in a given position against a force trying to overcome the holding action, such as a pull or push exercised by another person, gravity or the tension of a spring. While muscle tone accompanies muscle power, it is not identical with it, and one frequently sees fairly strong muscles which are not adequate to the task of holding the limb in a given position. Stabilization of joints is of utmost importance. In this connection it is necessary to remember that the joints are stabilized only partly by their ligaments and to a much greater degree by their muscles. It is lack of muscle tone which in many instances causes recurrent injuries in joints that are inadequately stabilized by their muscles.

However, when limitation of motion exists which may be due partly or totally to muscle spasm, tone exercises will have to be omitted or performed very carefully in order to prevent increase of spasm. Pain may prohibit the development of muscle tone and, as always, should be properly treated.

3. *Elasticity*. — Elasticity is that quality of the muscle which enables it to adapt itself to a certain length without straining its fibers.

A further criterion of muscle elasticity is the time required by a muscle to attain its maximum length and the number of times it can be brought to that length without reaction. Forcing a muscle to its maximum in less than its normal time limit will result in partial or complete tears of the muscle and subsequent muscle spasm. Bringing the muscle to a given length too many times in succession also will result in muscle spasm.<sup>22</sup>

Exercises to provide elasticity are those which increase the potential length of the muscle. The increase cannot be accomplished primarily by stretching. Limitation of motion is often due to muscle spasm, and muscle spasm results in inelasticity of the muscle. Any attempt to stretch the muscle forcibly to its normal length will cause partial tears. Not only will these tears be painful and thus increase muscle spasm and limitation of motion, but inflammation so produced may heal with scar formations, creating a further obstacle to future mobilization.

Muscle spasm is increased by almost every irritation to the muscle. Other causes of muscle spasm are:<sup>22-23</sup> muscle injury, cold, relatively insufficient circulation such as that present in a resting muscle, too fast and repeated first movements and muscle exhaustion. Untrained, atrophic muscles and weak muscles are quickly exhausted and therefore subject to muscle spasm. All this shows how carefully the treatment of muscle spasm must be conducted. Any pulling or forced stretching will cause minor tears, pain and more spasm.

The sequence of steps leading to normal elasticity will, therefore, be just as gradual as that described for building up muscle power. Stretching of a muscle to its normal length is done by its antagonist. This is active stretching brought on by reflex relaxation of the muscle. Thus, the first step will be to have the antagonist work with gradually increasing strength against the shortened, spastic muscle. This must be done gradually and

with the body region supported either by resting it or with the hands. Jerky movements should be avoided to prevent a certain explosive action of the antagonist which might cause tears of the involved muscle. The spastic muscle will have to be "warmed up"; i. e., it will have to do some power-building exercises first in order to increase its circulation. In later stages, cautious help can be given to the antagonist, but this help should never result in forcible manipulations.

Relaxing exercises are part of this group. These differ from the stretching exercises in so far as they do not tend to restore a certain length of the muscle but try to make the muscle assume a length greater than that required by the tendons of its attachments. Contracting a muscle group by reflex action releases its antagonist. This impulse can be used as the first, most gentle way of relaxation. In order to make this possible, it is important to teach the patient the feeling of tension and relaxation, which can be done by asking him to tighten a certain muscle and then to relax the tension.

4. *Coordination.* — Coordination is the correct and timely play of all muscle groups required for a certain action. I shall not discuss here all the cerebral and nervous components influencing coordination, but again concentrate only on its muscular aspects.

In order to achieve correct coordination the three previous qualities of muscle have to be present. In addition, the patient has to have the correct feeling for how and when to use those qualities. A limb may be perfect in all qualities except coordination, and thus, for example, be unable to lift a heavy weight. It may have good muscle tone and full range of function, and yet not be able to perform a certain task if it demands velocity, as does jumping or throwing. These activities may be important in the daily occupation of the patient or in athletics. Therefore, consideration has to be given to the tasks which the injured extremity is called on to execute, and in the last stage the treatment should be based on the movements of the patient's occupation, for example on jerky movements and jumping. Occupational therapy is helpful but will not fill the requirements. It does not cover all the movements that may be needed. Also, it involves complex movements which may be difficult for the patient and cause him to develop substitution of other muscles. There is no advantage in developing compensatory movements unless there is no other way of getting the patient back to his usual occupation. Compensatory movement means that one or more muscles of the injured joint are being favored or put completely out of use. As previously stated, they will never return to their normal strength unless they are made to function in the course of rehabilitation. Consequently, occupational therapy should not enter this phase of the treatment except when it is employed either as a final step to normal use or as a means of developing compensatory movement when nothing better can be expected.

#### Methods of Performance

Some of the means by which to obtain muscle rehabilitation have been mentioned. It may be expedient to give a brief summary and analysis.

Guided movement is indicated for a joint with limited range of motion and limitation in all the qualities of its muscles.

It will be well to remember that such a joint will have a different functional ability in every sector of its range. Its action over the middle range may be near normal. The muscles may be strong enough to support not only the limb but additional weight, and motion may be pain free and easy. Adjacent ranges may show the muscle strong enough to support the weight

of the limb but not strong enough to support additional weight, and lack of elasticity may be felt. In other sectors of the range of motion the muscles may be too weak to overcome even the weight of the limb, and the elasticity is definitely strained.

In addition to the guiding of movement, gentle helping of the muscles of the antagonist group may further increase the active range of the joint.

It is the purpose of guided movement to extend the range of motion gradually by applying resistance, finally assisting the muscles to gain the extremes of motion by gentle pushing.

The use of weight is not uniformly adaptable to the various muscle functions in the total range of movement of a joint. The weight is always the same. It always produces its effect on the same muscle group, on lifting as well as on lowering. On lowering the weight, the muscle has to release its contraction gradually. Sometimes this is difficult, especially if the weight approaches the maximum tolerated.

Weights will be used, therefore, only when the muscle is able to fulfill this double task and then only to an amount which can be lifted easily.

Springs are not used often, but when they are used it must be remembered that in pulling a spring one gets an increase of resistance toward the end of the range of movement, which means an increase of resistance at exactly the stage when a muscle is least able to overcome it. The same thing holds true if a spring is being compressed instead of pulled.

Pulleys are to be used in order to enable the patient to give aid to his injured limbs with his hands. Compensatory movements will have to be watched for and guarded against, especially when the used pulley is used for a shoulder joint. Often, the patient, trying to lift the other shoulder with his healthy arm, merely bends his spine or lifts the scapula instead of employing scapular-humeral joint movements.

Stretching and relaxing exercises, as well as tone exercises, have been described sufficiently.

Alternating of movements between injured and healthy extremities is helpful, for the injured side can learn from the uninjured.

Supporting an injured extremity with the uninjured one can be helpful if, again, compensatory movements are watched.

Exercises under water are helpful when the weight of the part under treatment cannot be managed without support. But it is important to have a sufficient amount of the body submerged. For example, putting a hand in a small tub of water in order to aid wrist motion does not give optimal results, because elbow and shoulder have to be held in a forced position, and the wrist is not allowed to move as freely as necessary.

The movements prescribed will have to be simple, so that they can be remembered and correctly repeated by the patient. Complicated movements should be reserved for later stages of the treatment, when coordination is being trained. Then it is well to build them up step by step from their elements. It is essential to watch the patient do the movements correctly a number of times so that any improper movement can be eliminated. At the same time, the patient can be instructed how slowly the movement has to be made. If possible, instructions should be extended to a regular training period of fifteen to thirty minutes twice a week under supervision of an efficient assistant.

Movements should be done slowly so as not to encourage muscle spasm and so as to make possible their correct and proper execution. They should not be repeated to the point of tiring the patient. They should be done at least once and preferably twice a day. In cases in which active motion must

prevent the stiffening of an injured joint or in which a stiffened joint must be mobilized, the exercises should be repeated frequently during the day, every hour if necessary, but for only two to five minutes at each repetition. An entirely different result is obtained if the patient executes a certain exercise once a day for an hour from that obtained if the same exercise is executed twelve times a day for five minutes each time. Exhaustion and muscle spasm may result from the former method, while the latter may keep the patient limbered up and increase the motion of his joint.

The exercises should be continued until the patient has regained the normal use of his extremity.

### Organization of the Treatment

A nucleus for the organization of active motion should be formed wherever the treatment of injuries is undertaken on a large scale.<sup>5</sup> It is imperative that the physician in charge should be conversant with the treatment of fractures in addition to having an adequate knowledge of muscle rehabilitation. This person should be responsible for the correct enforcement of the basic principles of active motion whenever it is prescribed.

Sometimes it may be advantageous to have the patients perform the exercises in groups. Not only does this save time, but it has been found that the patients like to work together and that the competitive spirit among them adds to the effectiveness of the treatment. Whenever group work is practiced, it is advisable to set up a separate clinic with a special technician. The technician should be well trained and constantly supervised by the surgeon in charge.

Patients should be grouped according to the joints being treated (in groups for knee joints, ankle joints, shoulders, etc.). A number of sets of exercises should be provided for every joint, ranging from easy exercises for the beginning of the treatment to a complete work-out. All the qualities described should be taken into account in the complete setup, and every patient should receive a prescription as to the type of exercises he needs and how often and how long they should be performed.

The results of conducting such an exercise clinic will prove doubly gratifying. For, in addition to cutting down the treatment period and producing more complete rehabilitation, it will furnish the physician in charge an excellent field for the analysis of active motion. His experience in this clinic, combined with observations of athletes and workers, will provide information on motion and muscle action that will contribute materially both to the knowledge of muscle rehabilitation and to the diagnosis of ailments of the locomotive apparatus. More and more he will come to see that the scope of muscle ailments is much wider and more consequential than generally realized.

At the present time it is especially vital for national defense to get able-bodied but injured persons back to work, whether in the factory or in the armed forces. Concentrated efforts are being made to cut down the disability period of fractures. Most of these efforts concern the treatment of the bones themselves in its every phase. The less spectacular, but equally important, treatment by active motion must keep abreast. It is of little avail to gain weeks and even months in a relatively small number of major cases, only to lose months and years by neglecting the further rehabilitation of the patients. The treatment of the indefinitely greater number of minor, individually less significant injuries can be shortened considerably and the number of working days thereby gained will add up to a remarkable figure.

36 Central Park South.

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## ULTRAVIOLET IRRADIATION OF BLOOD IN THE TREATMENT OF ESCHERICHIA COLI SEPTICEMIA \*

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If the conception of septicemia as the presence of pathogenic organisms in a patient's blood plus septic symptoms holds true, then 7 patients with *Escherichia coli* septicemia have been treated in the Shadyside Hospital by the Knott technic of ultraviolet irradiation of blood. Briefly, this therapy consists in exposing the patient's own citrated blood to the ultraviolet rays from a water-cooled ultraviolet lamp at contact; the exposure is approximately one second per cubic centimeter. Publications of Hancock and Knott,<sup>1</sup> Barrett,<sup>2,3</sup> Miley<sup>4,5</sup> and Rebbeck<sup>6,7</sup> describe in detail the technic of this procedure.

The rationale of blood irradiation therapy is based on accepted biophysical effects of ultraviolet rays, chiefly those of detoxification and inactivation of bacteria, toxins and viruses. From a clinical point of view, any therapeutic measure that raises the patient's resistance to infection by inactivation or destruction of bacteria and neutralization or inactivation of the products of bacterial action should be useful as an adjunct in the treatment of infections. The physical principle, that any substance which is capable of absorbing ultraviolet rays (such as blood is known to be) gives off secondary emanations, would explain the ultimate destruction of bacteria in the blood. The commonly seen detoxifying action of ultraviolet rays as reported in the references cited, explains the beneficial effect of this therapy in helping the patient overcome his infection. The cases I wish to report are as follows:

CASE 1. — Postoperative prostatectomy with double septicemia (*Esch. coli* and *streptococcus haemolyticus*); recovery.

CASE 2. — Bilateral pyelonephritis with *Esch. coli* septicemia; recovery.

CASE 3. — Acute pyelitis with *Esch. coli* septicemia; recovery.

CASE 4. — Incomplete septic abortion with *Esch. coli* septicemia; recovery.

CASE 5. — Acute pyelonephritis, cirrhosis of the liver, myocardial degeneration with acute dilatation, general anasarca, *Esch. coli* septicemia; death.

CASE 6. — Acute appendicitis with abscess, multiple abscesses of the liver, acute pyelonephritis, bilateral terminal bronchopneumonia with *Esch. coli* and *Staphylococcus aureus haemolyticus* septicemia; death.

CASE 7. — Probable acute appendicitis with abscess formation; *Esch. coli* septicemia; recovery.

CASE 8. — Fever of undetermined origin, infected hydronephrosis, right (?); recovery.

It is interesting to note that of the 2 patients who died, one (patient 5) was reported at autopsy to have a sterile blood stream and the other (patient 6) at autopsy showed only *Staph. aureus haemolyticus* in the blood stream. (It has been our experience that *Staph. aureus* septicemia does not respond well to this type of therapy.)

Patient 4, who had an incomplete septic abortion and showed profuse growth of *Esch. coli* in the blood before blood irradiation therapy, was curetted (a sharp curet and placental forceps being used) the day after irradiation and showed the same organism in material obtained from the uterus. She made an uneventful recovery and was discharged in five days.

Patient 3, with acute pyelitis, was extremely toxic and showed *Esch. coli* in

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the blood stream before irradiation. The day after irradiation she was considerably improved, her blood stream was sterile and cystoscopy was performed, and she was discharged in good condition on the sixth postirradiation day.

We believe that cases 1, 2 and 7 are of sufficient interest to merit more detailed descriptions.

CASE 1.—Mr. B., a white man, aged 76, was admitted to the Shadyside Hospital on March 25, 1940, to the service of Dr. R. A. Walther. Physical examination revealed an

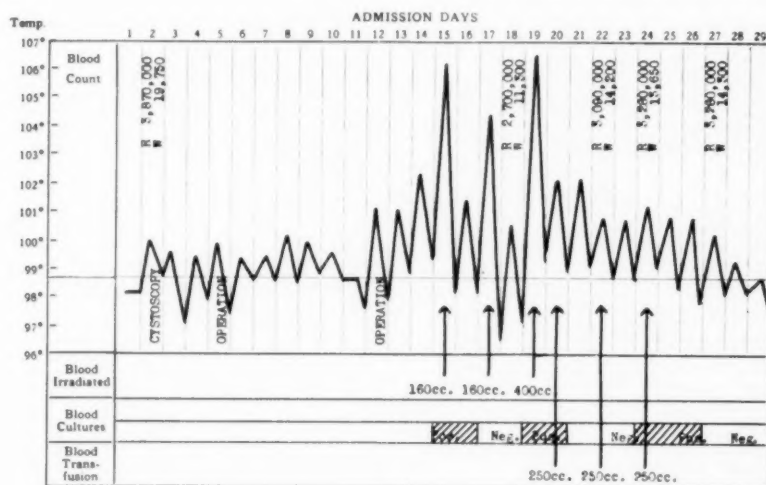


Fig. 1A

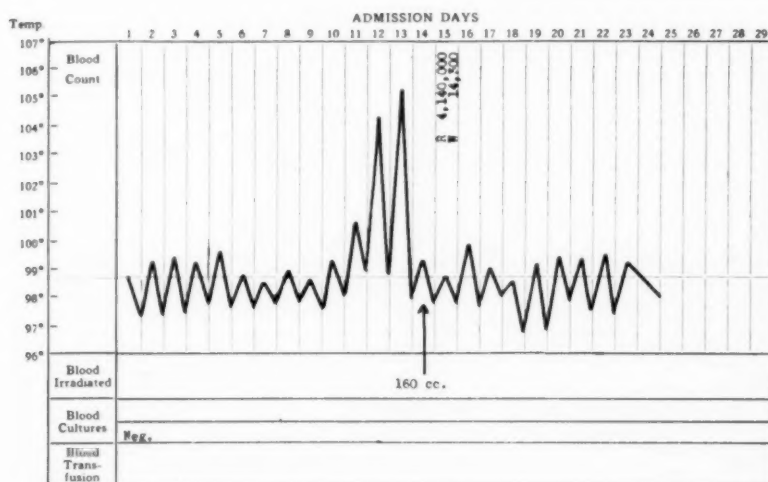


Fig. 1B

Fig. 1, A, B (case 1). — Diagnosis: double septicemia, *Esch. coli* and *Strep. haemolyticus*, following prostatectomy.

enlarged prostate and the characteristic symptoms of dysuria, frequency and occasional retention of urine. A cystoscopy was done March 26, revealing that the bladder was holding 24 ounces of thick bloody urine. The fundus of the bladder was normal except as part of the general trabeculation. No stones or growths were noted. The openings of the ureters were not seen because of a large ball valve prostatic enlargement. A Foley catheter was placed in the bladder for continuous drainage. On this day the patient was confused and lethargic. Routine examination of the blood showed 3,870,000 red cells, 19,750 white cells,

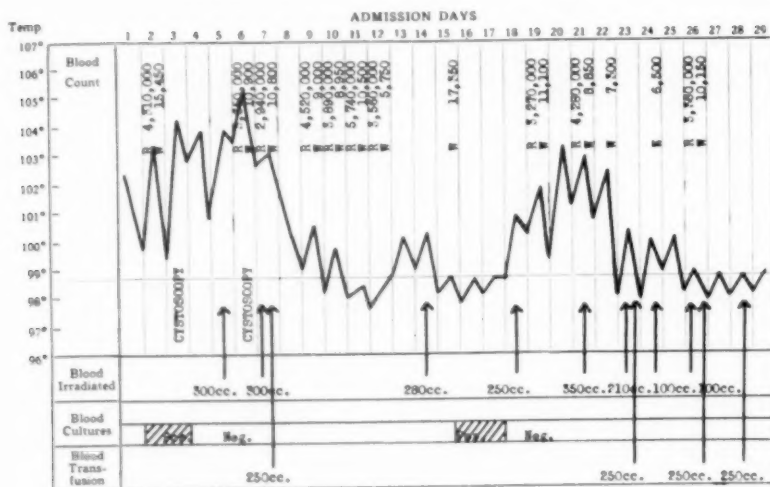


Fig. 2A

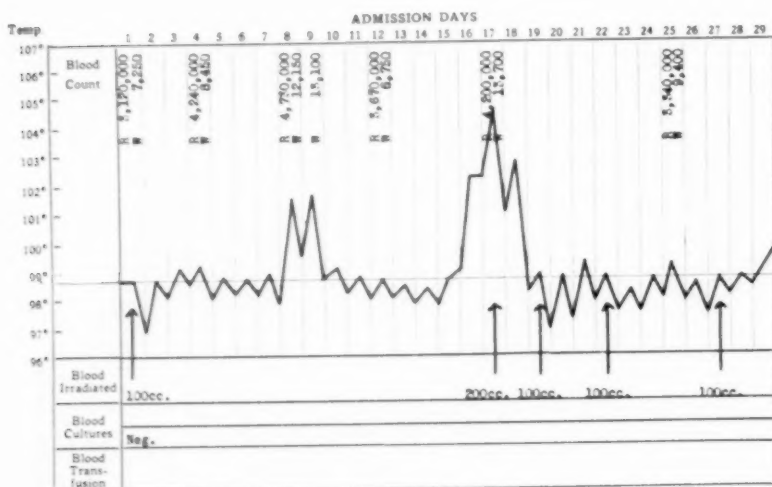


Fig. 2B

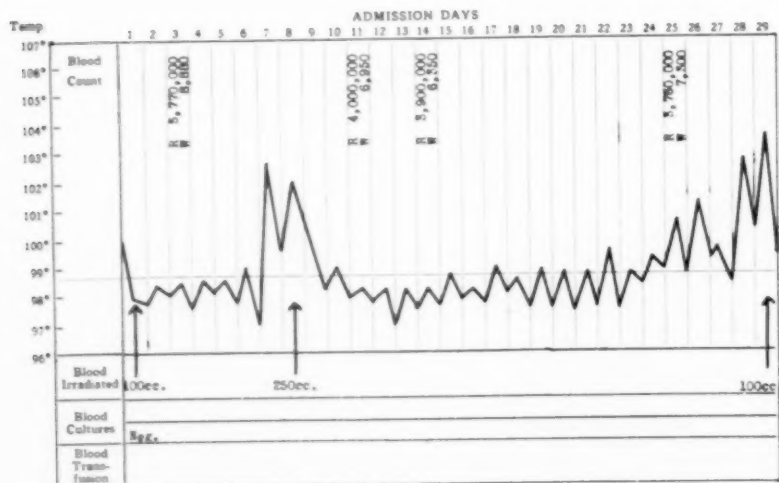


Fig. 2C

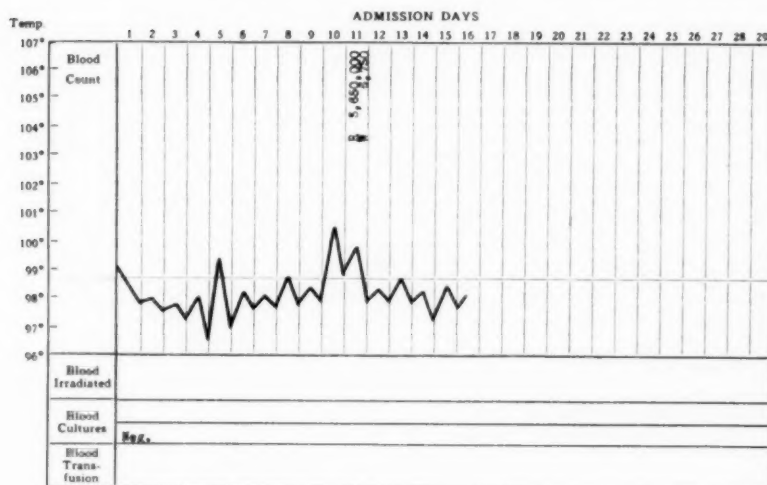
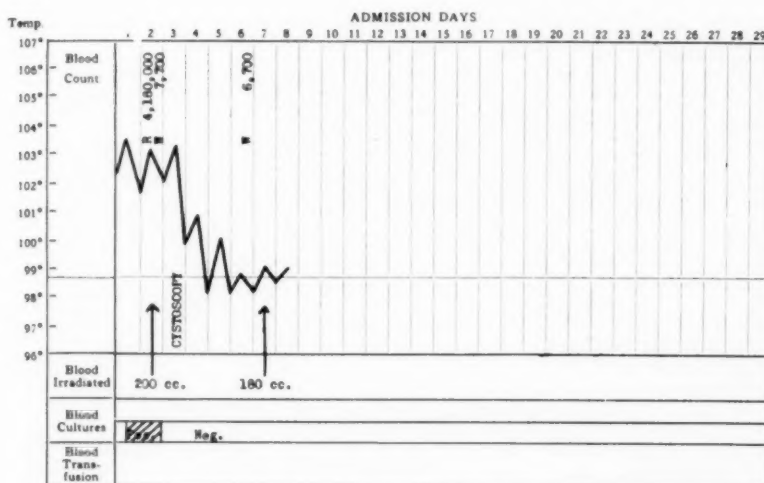


Fig. 2D

Fig. 2, A, B, C, D, (case 2). — Diagnosis: bilateral pyelonephritis, *Esch. coli* septicemia, right.

Fig. 3 (case 3). — Diagnosis: *Esch. coli* septicemia, acute pyelitis.

79 per cent neutrophils (54 per cent filamented, 25 per cent nonfilamented), 14.4 gm. of hemoglobin, 26 mg. of urea nitrogen and 108 mg. of sugar.

With forcing of fluids intravenously, the patient was much improved by March 28. On the morning of March 29, suprapubic cystotomy was performed. His general condition after this operation seemed fair until April 1, when he became confused, restless and toxic. These symptoms gradually subsided by April 5, when he was considered to be in condition for operation, and a suprapubic prostatectomy was performed. The first two postoperative days his temperature ranged from 100 to 102 F., and in general his postoperative condition seemed satisfactory. However, April 8, after a thirty minute chill, his temperature rose rapidly in the early morning to 105.8 F. and fell to 100 F. by noon. No evidence of bleeding was found. Drainage of the bladder was good. The blood urea content was 21.4 mg. per hundred cubic centimeters. Two blood cultures taken April 8 later showed *Esch. coli* and *Strep. haemolyticus*, with the subcultures showing a profuse growth of *Esch. coli* with few streptococci.

Blood irradiation therapy was instituted the afternoon of April 8 and repeated on April 10 and 12. Blood transfusions of 250 cc. each were given April 13, 15 and 17. Blood

cultures taken April 10, and 11 were negative. The blood culture taken April 12, before the irradiation, showed profuse growth of *Esch. coli*.

Another blood culture, taken April 17, after a chill, showed moderate growth of *Esch. coli*, but the patient's temperature reached only 102 F. He improved nicely, with good urinary output, until May 3, when replacement of his Foley catheter was followed by excursion of the temperature to 105.2 F. Because of this excursion and as a prophylactic

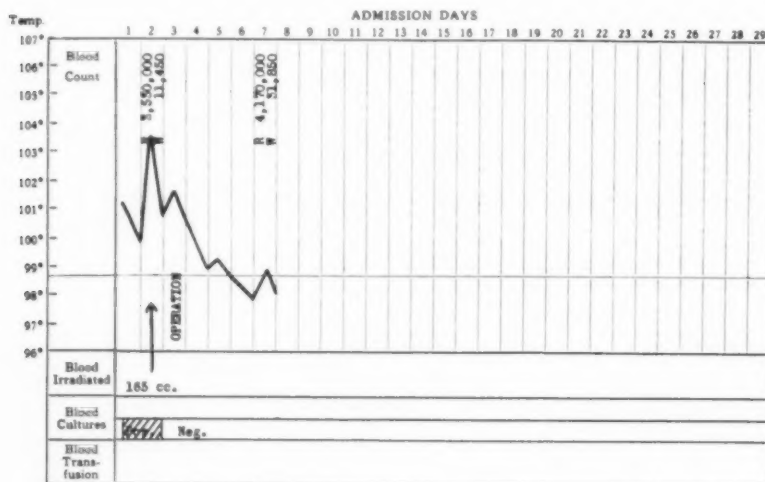


Fig. 4 (case 4). — Diagnosis: *Esch. coli* septicemia, acute endometritis, acute parametritis.

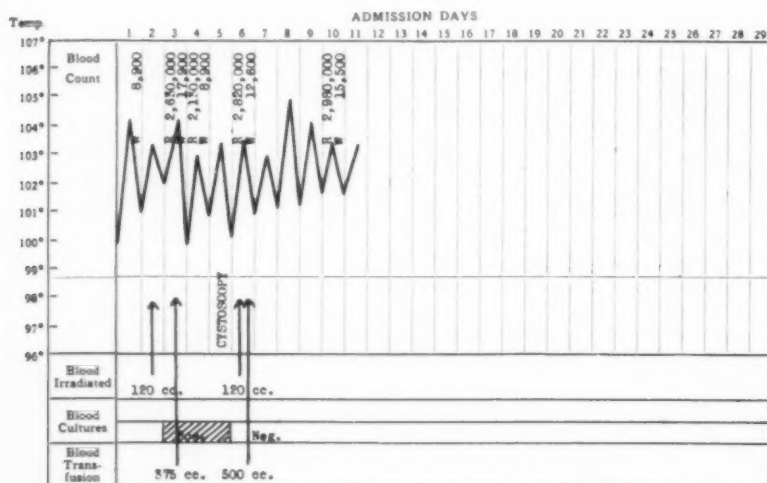


Fig. 5 (case 5). — Diagnosis: *Esch. coli* septicemia, acute bilateral pyelonephritis.

measure, another blood irradiation treatment was given May 6. From this date the patient made an uneventful recovery, and he was discharged from the hospital on May 16. When last heard from, in May, 1942, the patient was living and apparently in fairly good health.

CASE 2. — Mr. B., aged 45, was admitted to the Shadyside Hospital to the service of Dr. E. S. Leibensperger on Nov. 21, 1940, with a diagnosis of acute bilateral pyelonephritis. He had been treated for the same condition two weeks previously (hospitalized for eleven days) with intensive sulfanilamide therapy and seemed to improve considerably; however, his symptoms recurred, necessitating readmission. His temperature at admission was 102.8 F., his pulse rate 96 and his respiratory rate 22. Examination of the blood at admission showed 4,310,000 red cells, 13.8 gm. of hemoglobin, 15,450 leukocytes, 86 per cent neutrophils

(61 per cent filamented, 25 per cent nonfilamented), a sedimentation distance of 85 mm. in one hour and 17.4 mg. of blood urea per hundred cubic centimeters. The urine showed an alkaline reaction, a trace of albumin, a moderate number of leukocytes and occasional erythrocytes. Blood culture on admission showed *Esch. coli* and again was positive on December 6. Frequent cultures in the interim and up to Feb. 15, 1941, were negative. The

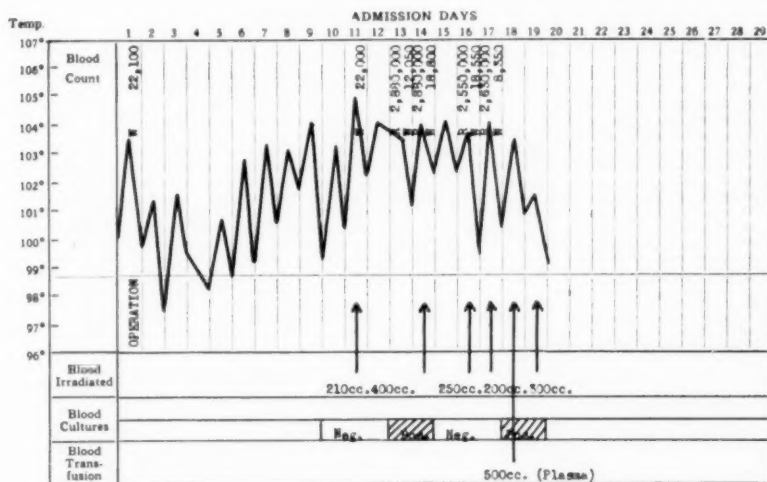


Fig. 6 (case 6). — Diagnosis: double septicemia, *Esch. coli* and *Staph. aureus* haemolyticus; acute appendicitis with abscess; multiple abscesses of the liver.

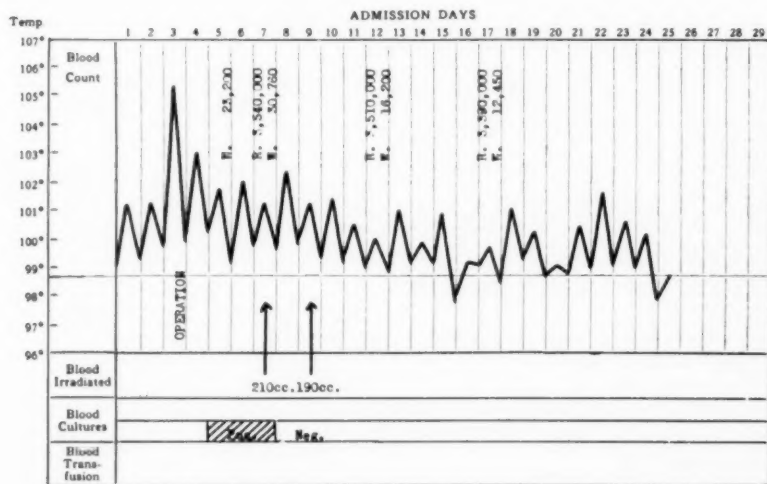


Fig. 7 (case 7). — Diagnosis: *Esch. coli* septicemia, probable acute appendicitis with abscess formation.

urine consistently showed *Esch. coli* up to February 27. Cystoscopy was performed and the ureters dilated on Nov. 23 and Nov. 26, 1940.

Fifteen blood irradiations were given from Nov. 25, 1940 to Feb. 15, 1941. Most of these were fractional treatments of 100 cc. of blood and were given primarily when excursions of fever occurred. One transfusion of 250 cc. was given December 13. Two doses of azosulfamide, 15 grains each, were given on December 3, and then this treatment was canceled. Other medicinal therapy included use of methylene blue and methenamine with sodium acid phosphate. When epididymitis on the right side occurred January 13, the medicinal therapy consisted of administration of sodium iodide and salicylate intravenously.

and of sulfathiazole. In addition, several doses of autogenous vaccine of *Esch. coli* in doses of 0.03 cc. were given for a period of about one month. The patient's early clinical course was extremely stormy, with days of delirium, marked toxemia, intense pain and tenderness in both kidney regions, marked dysuria, etc. Significantly, the pain in both kidney regions was considerably relieved the day after irradiation. The patient was extremely septic, and in the early stages of his illness his condition was considered hopeless by his attending physicians; however, by approximately the twenty-fifth day after admission he was well on the way to recovery, with little toxemia. Aside from one minor complication, namely epididymitis, and absorptive fever, he progressed to complete recovery, to be discharged from the hospital on March 3. His subsequent progress was uneventful. He returned to work and was apparently in good health when last seen, about six months after his discharge.

**CASE 7.**—Mr. G., aged 31, was admitted on June 2, 1942. He had been sick for several days, with considerable pain in his right flank, lower abdomen and lower back. The temperature on admission was 99 F. and the pulse rate 88. A diagnosis of lumbosacral strain was made by his physician. Manipulation of his back under intravenous anesthesia was done on June 4, 1942, after which a chill occurred, with a rise in temperature to 106.4 F., a pulse rate of 138 and a respiratory rate of 26. Considerable fever persisted, with marked toxemia, sores on the lips and extreme pain throughout the right side of the abdomen, back and upper thigh. The right leg was held continuously in flexion. Blood cultures taken June 6

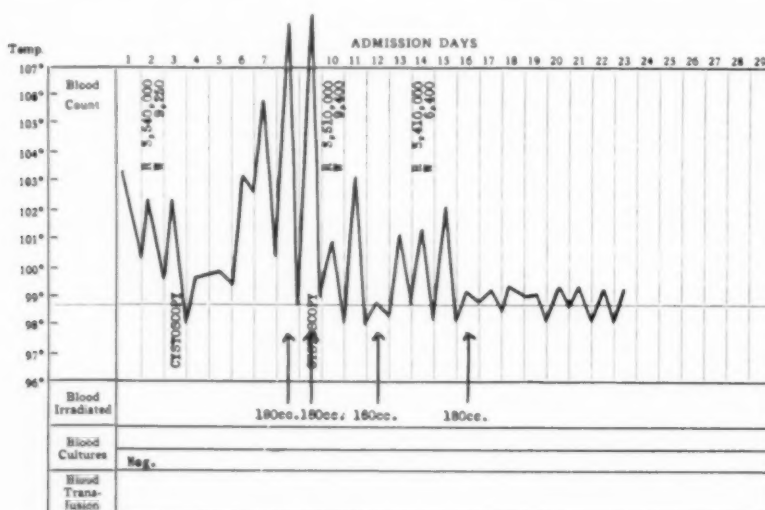


Fig. 8 (case 8).—Diagnosis: fever of undetermined origin, infected hydronephrosis, right (?).

and 8 subsequently showed profuse growth of *Esch. coli*. Sulfathiazole, 105 grains, was administered on June 7. On June 8 the patient was extremely septic, complaining of extreme pain; the temperature reached 104 F., and no localization for surgical intervention was apparent. Blood irradiation therapy was given June 8 and repeated on June 10. On June 9 localization occurred in the right lower part of the abdomen. Incision and drainage were performed and about 3,000 cc. of colon-odored pus removed. The probable diagnosis was acute appendicitis with abscess and perforation. The patient slowly recovered, with no more positive blood cultures, and aside from transient moderate rises in temperature from blocked drainage has slowly improved.

In addition, case 8, in which the blood cultures were negative and the patient extremely toxic, serves to demonstrate the detoxifying effect of this therapy:

**CASE 8.**—A woman aged 36 was admitted to the Shadyside Hospital June 24, 1941 with a history of awakening early in the morning of June 21 because of severe chills. These were accompanied by vomiting, a moderate amount of pain in the right kidney region and moderate urinary frequency and burning. These symptoms persisted through the next few days, accompanied by fever and an increase in the pulse rate. A blood count on admission showed 3,590,000 red cells; 13.8 gm. of hemoglobin, 9,250 leukocytes and



69 per cent neutrophils (49 per cent filamented, 20 per cent nonfilamented). Examination of the urine revealed an alkaline reaction, much albumin, a moderate number of leukocytes and many erythrocytes. The temperature at admission was 103 F., the pulse rate 104 and the respiratory rate 22. A provisional diagnosis of acute pyelitis on the right side was made.

Cystoscopic examination performed June 26, with a pyclogram made, showed a positive diagnosis of hydronephrosis on the right side. No organisms could be cultured from the urine or either kidney. The blood cultures taken June 26 and July 1, 2 and 3 were all negative. Sulfathiazole in doses of 15 grains three times a day was given from June 27 to June 30. The patient's temperature after cystoscopy and sulfathiazole therapy gradually receded until June 29. The patient was not particularly toxic. Chills were absent during this interval. On June 29, after a chill, her temperature reached 104.8 F. and the pulse rate 130, and during the next few days, with recurring chills, her temperature reached as high as 109 F. and her pulse rate 140, on the morning of July 1. The patient by this time had pains in both elbow joints and was extremely weak, lethargic and apprehensive. On July 2 her temperature reached 109.5 F., with the pulse rate 140. She complained of pains in both knee joints and in the lower part of the abdomen. There was considerable vomiting of coffee ground vomitus. Blood irradiation therapy was instituted on July 1 and again on July 2. Cystoscopy was again performed on July 3. The peak temperature on this day was 103 F. The patient was much brighter; chills had ceased; toxic symptoms were much less. The urinary intake on this day was 98 ounces and the output 61 ounces. The same general proportion held throughout the patient's stay in the hospital.

Blood irradiation was performed again on July 5 and, because of a tendency to febrile increase, on July 9. From this point the patient made an uneventful recovery, as shown by the accompanying chart, and she was discharged in good condition on July 16. Her subsequent progress at home was uneventful.

To summarize, 7 cases of *Esch. coli* septicemia have been reported, 3 in detail. It is my belief, based on five years of experience with this therapy, that in case 6, of acute appendicitis with abscesses (*Esch. coli* and *Staph. aureus* septicemia), the patient might have recovered had irradiation therapy been instituted at or near the time of operation instead of ten days later. The other fatal case, case 5, is interesting because of the sterile blood stream at autopsy. I feel that the advanced pathologic changes found at autopsy would preclude beneficial effects from any type of therapy.

There have been no signs of harmful effects in approximately four thousand blood irradiation treatments with the Knott technic under my direct supervision at Shadyside Hospital in the past five years. If one looks at the over-all picture of serious infections and realizes that accepted methods of therapy fall far short of producing consistently good results, one appreciates that there is room for any logical, harmless type of therapy such as the ultraviolet irradiation of blood presents.

### Discussion

**Dr. G. J. P. Barger** (Washington, D. C.): Dr. Rebbeck has presented three types of use being made of the Knott mechanical device and technic for the irradiation of the blood and other solutions by accurate and uniform doses of ultraviolet light. (1) He has inactivated 160 autogenous vaccines by ultraviolet light, thus providing vaccines more potent than those inactivated by other methods. (2) He has been able to save 5 out of 7 cases of *Escherichia coli* septicemia, which by all previous experience would have all been fatal. (3) He has presented an illustrative case of the ability of this irradiation technic to inactivate an almost overwhelming toxemia in which no causative organism could be isolated.

I would like also to call attention to previous reports by Dr. Rebbeck on this line of therapy. In the *American Journal of Surgery*, Dec., 1941, he reported its use in the treatment of puerperal sepsis, with his

conclusions "that the high percentage of excellent clinical response is unmatched in our experience, by any other type of therapy." In the March, 1942, issue of *The American Journal of Surgery*, he reported on its use in 21 cases of postabortal sepsis, with the following conclusions: "Our experience with this therapy in the treatment of postabortal sepsis prior to and after curettment, indicates that in hemo-irradiation we have a valuable adjunct to the practice of surgery. Practically no increase in temperature was noted following surgery when hemo-irradiation was administered preoperatively. Definite protection was afforded against the usual disastrous spread of the uterine infection in the pelvis or into the blood stream. In cases of pronounced sepsis a remarkable reduction in the manifestations of toxemia was achieved."

Dr. Rebbeck has been moderate in com-

ment on his results in conditions that usually show a high mortality rate.

For seventeen years Dr. E. K. Knott has worked to perfect the technic by which one may uniformly irradiate a volume of blood, to determine the most suitable collection of ultraviolet wave bands for this purpose, to determine the effective time range in dosage, to determine the various factors involved in providing a constant energy dosage and to bring to perfection the mechanical device which would enable this dosage to be consistently attained and maintained.

The effective and safe range of exposure of the blood as it flows turbulently through the irradiating chamber is surprisingly small, being from nine to fourteen seconds, applied to a volume of blood equal to  $1\frac{1}{2}$  cc. of blood per pound of body weight. An exposure less than that is relatively ineffective, above that it is increasingly toxic to the body. Within that range of exposure it is powerfully effective and safe.

As unobtrusively through these years a few medical men working with Dr. Knott have been accumulating the clinical experience and data regarding its range of application. With some 15,000 irradiations, mostly in hospital records and with the experiences of different workers closely comparable, they are more actively presenting ultraviolet irradiation of autotransfused blood to the medical profession as a demonstrated value, though its full range of application is yet to be delimited.

In the scientific exhibits of the convention of the American Medical Association, 1940, a small group of men who were working with Dr. Knott pooled their clinical experience with this therapy in connection with pyogenic infections. This was again presented in 1941 at the American Congress of Physical Therapy, as a scientific exhibit. Ten or a dozen papers on this subject have been presented to the medical profession since Dr. Knott's original paper in 1934.

At the present time responsible medical workers and groups of workers are in the process of testing out the effectiveness of ultraviolet irradiation of autotransfused blood in poliomyelitis, undulant fever, coronary disease, acute and chronic arthritis, asthma, tubercular sinuses, typhoid fever, thrombophlebitis, besides their continued work in the pyogenic infections, though no published statements have been on these conditions. The results in septic abortions have been so impressive that at one large hospital where this service is available, the ultraviolet irradiation of autotransfused blood has been made standard treatment for all abortion cases.

At the present time, this much can be said with confidence in regard to the ultraviolet irradiation of autotransfused blood: It is effective in all the conditions for which the sulfa drugs are used; it is successful in many conditions after the sulfa drugs have failed; given by the Knott technic, which includes scrupulous aseptic technic, it is not followed by any of the damaging effects that are common to the

sulfa drugs; it is effective in a wider range of bacterial and virus infections than are the sulfa drugs; it is effective in inactivating various types of destructive toxins; it furnishes a device for uniformly irradiating bacterial and virus suspensions for the preparation of vaccines and that it promotes a widespread and prolonged dilatation of peripheral capillaries.

**Dr. Roswell Lowry** (Cleveland, Ohio): I wish to compliment Dr. Rebbeck on the excellent presentation. It is important to know that we have an additional weapon to fight pyogenic infections which bids fair to outshine the sulfonamide group of drugs. Dr. Rebbeck has shown that ultraviolet blood irradiation therapy is effective after the sulfonamides have failed. This has been my experience. Since October of 1941, I have been using this therapy in Huron Road Hospital at East Cleveland. Although the number of cases is not comparable to Dr. Rebbeck's, I feel our results are. We have given more than 200 irradiations to 100 patients. Of these 100 patients, 5 were surgical cases with marked toxemia from pyogenic infections, 3 had pelvic abscesses and 2 had generalized peritonitis. These patients were first given a thorough course of sulfonamides with no success.

One thing important to observe from Dr. Rebbeck's paper is that the dictum of early treatment holds good here as in any other procedure. His point is well illustrated in the report of a list of cases treated at Hahnemann Hospital, Philadelphia and was published in the *New York State Medical Journal* of January, 1942.

I should like to emphasize a few points that are clinically demonstrable during the treatment. I have seen angry, edematous infections subside in six to eight hours following blood irradiation therapy and in 24 hours be almost gone. This is at present not fully explained, but we do know that capillary dilatation can be demonstrated. Likewise, there are changes in the blood proteins which are not understood or demonstrated as yet. This may be a factor in the reduction of cellular edema.

I have irradiated two patients with so-called "hot salpingitis," who were operated on two weeks later and showed no pathologic change in the tubes.

Dr. Rebbeck has made use of this therapy before surgical procedures. Acting on his advice, I had occasion to irradiate 3 patients with badly infected tonsils, fever and acute rheumatoid arthritis. In each instance the tonsils were removed within forty-eight hours. The recoveries were uneventful. That is a far cry from the accepted surgical point of view today.

I believe there are many more uses for this therapy. But close study and strict adherence to the technic as set down by Hancock, Knott, Miley, and Rebbeck is necessary for successful results.

**Dr. Disraeli Kobak** (Chicago): I have had the special privilege accorded a discussor to study this report with the leisure

merited by its provocative content. Its reading under the more relaxing state of home environment touched off a train of thought pertaining to the trials of pioneers in medicine and the necessity often to suspend judgment in order to prevent lasting injury to patients, and separate the false from the true scientists in our midst and do lasting honor to the latter. One recalls that it took twenty-five years for Draper to re-discover the law enunciated by von Grotthuss and furnish proof of its imperishable meaning; it required over twenty years of unremitting toil and travail for Sister Kenny to synthesize the qualities inherent in hot fomentations and kinesitherapy as related to infantile paralysis. It is gratifying to observe that the discovery of Knott is painstakingly studied by a selected group of physicians whose only endeavor is to present to a conservative profession their critical evaluations for the prompt amelioration of certain pathologic states which heretofore have been grouped as among our most difficult of clinical problems. To the pioneers of this method no greater tribute can be advanced for their conservative stand than to point out that they have never abused their literary opportunities by ever coupling the hyphenated word "epoch-making" in their reprints, or that they had ever claimed that it was a new discovery.

Essentially this report is the latest of a series of highly promising clinical studies concerning the action of irradiated blood by a special process devised by Knott, which the essayist has used with provocative results in many septic states ranging from streptococcemia to the blood infection under consideration. From the view of its mechanical safety it can be stated that a sufficient period has elapsed during which practical modification in the apparatus and the technic has assured such perfection that it can be used by any competent surgeon. But perhaps the most significant fact to appreciate is that a concrete and objective observation has been repeatedly recorded concerning a new procedure of applying ultraviolet energy, so that it challenges the very latest of chemotherapeutic products to ameliorate or even cure those moribund states in which these have failed. To the inquiring mind this exciting and promising fact naturally stimulates a train of speculations all concerned with the action of the ultraviolet rays, their absorption and their means of recognition through their action on the constituent colloid particles in the blood plasma. I mention the colloid particles in the plasma of blood because it seems reasonable to assume that if the energy of ultraviolet radiation is absorbed in the blood stream one should be able to demonstrate any change by means of the dark field technic on the state of the ultra-microscopic particles, made visible through this method of illumination. The method is simple, and the possibilities for obtaining concrete facts that could better explain the dramatic detoxication of the pa-

tient are an assurance based on the laws of physical chemistry.

Finally the question arises, must one use the entire ultraviolet spectrum for irradiation purposes? Russ and Browning long ago demonstrated that for optimum bactericidal action, which no doubt also implies certain sterilizing effects, the rays between 2,960 and 2,100 angstroms are far more lethal than those between 3,800 and 2,900 angstroms. This fact is far more important than the assumption of secondary emanations as the answer for the detoxicating action claimed for this procedure. The apparatus emitting the richest source of bactericidal rays is to be found in any cold quartz generator on the market. Speaking with an eye toward future innovation although appreciating what Dr. Rebbeck has already demonstrated, the use of cold quartz appears to me both a plausible and practical suggestion.

**Dr. E. W. Rebbeck** (Closing): Dr. Kobak's mention of chylomicrons brings up some interesting work we have done in this connection. We exposed plasma from about 100 patients to the water cooled ultraviolet in small quartz tubes at contact for from five to forty seconds in each instance. Microscopic readings were made before exposure and after each five seconds. In many instances we were able to convert a greatly disturbed micron picture to normal. For instance a picture of fifteen to twenty chylomicrons clumped together with great variation in size and shape and no brownian movement, often changed to normalcy in five to fifteen seconds exposure. The normal picture would be that of no clumps, good brownian movement and all chylomicrons approximately the same size (i.e. about one half micron) and shape.

If, as has been claimed, the function of chylomicrons is one of adsorbing toxins, this action might well be very significant and be a factor in explaining the clinical detoxifying action of blood irradiation therapy.

One chief reason for our persistent and continuous work in blood irradiation therapy for the past five years, in spite of much opposition and criticism from the medical profession in the City of Pittsburgh, was the result obtained in my mother. She had asthma for many years, fairly well controlled by expert treatment. However, in the early summer of 1937, she started with uncontrollable attacks which lasted for over three months. Typically, she would go to bed around mid-night, sleep for maybe one to one and one-half hours and then awaken with severe wheezing and coughing, with great shortness of breath and no expectoration and spend the rest of the time sitting up for a measure of relief. Mother had this ultraviolet blood irradiation treatment in late September, 1937. That same evening she slept for five hours and when she did awaken, for the first time could expectorate. She had three treatments a week apart. Within about ten days the asthma was completely gone and has not returned,

(Continued on page 176)

## URGENT ANNOUNCEMENT FROM BOARD OF GOVERNORS

*The American Congress of Physical Therapy believes that any physician should be privileged to purchase physical therapy apparatus and use it according to the principles set forth by the Council on Physical Therapy of the American Medical Association in order that civilian health and productiveness may be maintained at as high a level as possible.*

*There has been issued recently (Feb. 15, 1943) an order by the War Production Board (Limitation Order L-259), signed by Curtis E. Calder, Director General for Operations, which bill by depriving physicians of the necessary physical therapy apparatus seriously curtails the rehabilitation of industrial workers whose continuous attendance at work and unimpaired efficiency are as essential to the successful conclusion of this war as are the activities of combatant units.*

*This order prohibits the manufacture of all physical therapy apparatus for private physicians. The American Congress of Physical Therapy believes that this order should be protested. The private practitioners of medicine on whose shoulders rests the responsibility of maintaining the health of the civilian population, so essential to the maintenance of the war effort, should not be denied the instrumentalities of achieving such an objective.*

*In order that you be not handicapped in your care of the sick and those injured in industry, it is of urgent importance that you at once make known your protest against this order. Do so through your representatives and senators in our national Congress, sending copies of your protest to the War Production Board, attention Mr. Curtis E. Calder, Director General for Operations.*

THE BOARD OF GOVERNORS  
OF THE  
AMERICAN CONGRESS OF PHYSICAL THERAPY.

Dr. Fred B. Moor	Dr. Kenneth Phillips
Dr. Kristian G. Hansson	Dr. O. Leonard Huddleston
Dr. Miland E. Knapp	Dr. Richard Kovacs
Dr. Walter S. McClellan	Dr. John S. Coulter
Dr. H. Worley Kendall	Dr. Walter J. Zeiter

**War Production Board**  
Washington, D. C.

February 15, 1943

L-259

To All Persons Engaged in the Business of Manufacturing or Selling Physical Therapy Equipment.

Gentlemen:

The great military demands for the critical materials going into the manufacture of physical therapy equipment have made it necessary to issue Limitation Order L-259, effective February 15, 1943, imposing strict limitations on the manufacture and distribution of this equipment. A copy of this Order is enclosed.

Your attention is first directed to paragraph (b) (1) which prohibits the continued manufacture, except to fill military or Lend-Lease purchase orders, of all physical therapy equipment other than those items specifically exempted in paragraph (b) (2).

With reference to paragraph (c), covering delivery of physical therapy equipment, the Order restricts the delivery of those items of which the continued manufacture is permitted. These items can be delivered only to the military services, Lend-Lease, Board of Economic Warfare (under export license), any hospital or medical department of an industrial concern, or any dealer or distributor who has furnished to his supplier a certification as required by Order L-259. The Order does not restrict the sale or delivery of existing stocks of any item of physical therapy equipment other than those items named in paragraph (c).

Paragraph (d) requires every manufacturer to file monthly production and shipping schedules covering all items of physical therapy equipment.

This Letter is intended merely to indicate the general nature of the restrictions appearing in Order L-259 and does not take the place of the Order itself, which should be referred to in order to determine the exact and official limitations or restrictions involved.

If you have any questions concerning the Order, please communicate with the Safety and Technical Equipment Division.

Thank you for your cooperation.

Very truly yours,

(Signed) F. M. SHIELDS, Director,  
Safety and Technical Equipment  
Division.

WAR PRODUCTION BOARD

L-259  
Feb. 15, 1943

Part 3187 — Physical Therapy Equipment  
(General Limitation Order L-259)

The fulfillment of requirements for the defense of the United States has created a shortage in the supply for defense, for private account and for export of the materials entering into the manufacture of physical therapy equipment; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense:

3187.1 General Limitation Order L-259 — (a) Definitions. For the purposes of this order:

(1) "Physical therapy equipment" means apparatus, equipment, devices and appliances designed to produce, generate, apply or administer spectral rays (except x-rays), electrical currents, mechanical stimuli, heat, refrigerants, liquids, gases or vapors to man or other animals in a manner designed to produce therapeutic effect or to destroy body tissue. The term shall include only the following articles, as each is hereinafter defined: medical diathermy units; surgical diathermy units; fever cabinets; infra-red generators, galvanic generators, faradic generators, sinusoidal generators, and any combination of such generators; whirlpool baths; paraffin baths; electric massagers; bath cabinets; therapeutic lamps; passive vascular exercise apparatus; baldness treatment devices; ultra-violet radiation equipment; electric bakers; and heat applicators. The aforementioned articles, as each is hereinafter defined, shall not include used or rebuilt equipment, nor any parts or materials for the repair or maintenance of existing equipment.

(2) "Medical diathermy unit" means any instrument designed to produce heat for therapeutic purposes within the body tissues by means of a high frequency electric current.

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# ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

## .. EDITORIALS ..

### PHYSICAL TREATMENT OF MENTAL DISORDERS

Within one hundred and fifty years the pendulum has swung far in the application of physical treatment measures to nervous and mental disorders. For many centuries, sufferers from mental disease were considered to be possessed by Satan and crude physical restraint in chains was the current method of their management. It was in 1798 when Philippe Pinel, physician of the ancient Saltpetriere Hospital in Paris took off the fetters of the insane there and first sponsored the use of various forms of water treatment for their sedative and tonic effect on mental illness. Gradually other forms of physical treatment were introduced, especially electricity, but at first without either rhyme or reason. In Haynes<sup>1</sup> popular text-book on electrotherapeutics printed some fifty years ago one can still read such statements as, "It is believed that the galvanic current penetrates the substance of the brain while the faradic current is distributed chiefly to the membranes," also "This rule has been given for the use of galvanism in insanity: recent cases and functional diseases are benefited by it while old cases and structural diseases resist its influence." No wonder that in text-books well known neurologists recommended the use of electricity more or less in the form of a placebo or as a convenient means of disguising suggestive therapeutics.

Present day knowledge in the conception of pathologic changes in the nervous system as well as in the known effects of physical treatment measures has brought much further progress in the application of physical treatment measures in this field. In changes of possible reversibility, due to inflammation, toxemia or disturbances of optimal excitability, measures for acceleration of resorption, for detoxication and for return of optimal excitability and also for the improvement of the intact part of the nervous system are being successfully applied. The most spectacular progress among these lines has been the use of artificial fever therapy in cerebrospinal lues. Not so many years ago the diagnosis of general paresis meant that the patient was doomed to finish his life as a hopeless mental derelict; now, modern chemotherapy combined with fever treatment offers a decided hope of recovery to every early case of general paresis. Fever therapy by physical means because of its ready availability, its sterility and easy regulability has largely superseded malarial treatment. Shock therapy has inaugurated in the past few years another impressive line of progress. In the evolution of this new treatment for the restoration of patients with depressive states, especially in those with psychomotor inhibition or retardation the physical method of electric shock therapy has proven superior to the earlier chemical method by insulin or metrazol. Banay's<sup>2</sup> article in this issue contains a first hand report on the wide applicability of this procedure for both treatment and prevention.

For the prevention and treatment of the border line cases of nervous exhaustion the time honored, but so far too little employed method of rest and relaxation has found an indomitable champion in Jacobson.<sup>3</sup> An earlier article<sup>4</sup> contains more details of the technic. It seems a pity that according



to the evidence at hand this clinician so far has been able to interest the lay public more than the medical profession in his theory and practice of progressive relaxation.

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### THE EXPANDING PROGRAM FOR TRAINING OF PHYSICAL THERAPY TECHNICIANS

Considerable progress is being made in increasing the output of trained physical therapy technicians to meet the present emergency. With the recent approval by the Council on Medical Education and Hospitals of the American Medical Association of the course for physical therapy technicians being offered at the Graduate Hospital of the University of Pennsylvania, there are now twenty-four centers in which qualified technicians can be trained. Twenty-two schools are approved, one of which, the approved Walter Reed School, now has two extensions, one at Fitzsimons Army Hospital in Denver, Colorado, and another at the Army and Navy Hospital at Hot Springs, Arkansas. This makes the total of twenty-four training centers for physical therapy, technicians.

In 1941 there were only sixteen approved schools for physical therapy technicians and one of these schools was inactive and a number of them had few students. In 1941 our approved schools for physical therapy technicians had a capacity of only about 500 students and in 1942 the capacity had reached 750 students. In 1941 only 238 students were graduated from approved schools, whereas in 1942, 426 students were graduated. The number of students in emergency courses increased from eighty-four in 1941 to 199 in 1942. The rest of the students graduated from regular courses.

Evidence indicates that the output of technicians in 1943 will considerably exceed that of 1942. The twenty-two approved schools now offer twenty regular and sixteen emergency courses. Early reports for 1943 from thirteen of these thirty-six courses in approved schools indicate that in these thirteen courses 223 students were enrolled for the first half of 1943. When all reports are in, it will probably be found that the greatest number of students ever trained in physical therapy technic will be graduated from our approved schools this year.

There is evidence that the needs of our governmental hospitals are gradually being met by this accelerated program for teaching of physical therapy technicians. Last May the United States Public Health Service needed fourteen technicians; now they need only three. Last May the Veterans' Bureau needed seventy technicians; now they need only forty. Last May the United States Army Medical Corps needed 778 technicians and now, although no specific figures can be given, it is reported that the needs are gradually being met. Last May the Navy was relying on its own corps men's schools for the provision of physical therapy technicians in the Navy Medical Corps. Recently, however, the Navy has decided to replace half of its corps men with women technicians who will be enlisted or commissioned in the WAVES.



It has been agreed that such technicians will be accepted only from approved schools. This will increase the demand for qualified technicians during the next year and will place an additional burden on the accelerated training program. Finally, it is obvious that the previously estimated need for 292 physical therapy technicians for civilian hospitals has not yet been met and that this need, as well as the military need must be considered before the accelerated program for training of physical therapy technicians is slackened.

It is now apparent that needs are gradually being met by the present program and that if our schools can continue turning out students at capacity, the emergency should be well met within the next two years. Everyone who is conducting or associated with an approved school for physical therapy technicians should make every effort to sustain the present program to the utmost until all the urgent demands have been met. Let's do everything we can to make an increasing number of well trained physical therapy technicians available to our governmental institutions and finally to our harassed civilian institutions. If satisfactory standards are to be retained, we must not fail in this effort.

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### CONTROL OF AIR BORNE INFECTION

Working at Harvard University, William F. and Mildred W. Wells<sup>1</sup> invented an apparatus and developed a technic which made it possible to explore the air for micro-organisms in controlled atmospheres. Liquid suspensions of micro-organisms could be atomized into a tank and their presence demonstrated quantitatively by the air centrifuge. These researches established that transmission of infection through the air may take one of two forms, depending on the size of the infected droplet. The more obvious form recognized by Flügge is droplet infection proper. It applies to droplets larger than 0.1 mm. in diameter, which are rapidly removed from the air by gravity before they can dry and within a short distance from the source. The second form may be called air borne infection and deals with the dried residue of infected droplets or droplet nuclei, derived directly from droplets less than 0.1 mm., depending primarily on air for the buoyancy that keeps them suspended for longer times and carries them longer distances. The Wellses<sup>2</sup> also investigated the bactericidal effect of ultraviolet radiation on micro-organisms suspended in air and proved it to be of a higher order of magnitude than humidity, ozone or commercial germicides.

With Wilder the Wellses<sup>3</sup> carried out a four years study in the Germantown Friends' School and a one year study in the Swarthmore public schools. They were able to report that, as the result of ultraviolet irradiation there has been no epidemic spread of contagion among the highly susceptible groups of children of primary schools, although epidemic spread has occurred among less susceptible groups of older children in the departments of schools whose atmospheres were not irradiated. The experiment supports the hypothesis that epidemic contagion is spread through the medium of confined atmospheres and that it can be prevented by radiant disinfection of air. Deryl Hart and his co-workers established that air is an important source of contamination in every operative wound and that sterilization of the air in the operating room can be accomplished by bactericidal irradiation.<sup>4</sup> Del Mundo and McKhann<sup>5</sup> reported that the hospital infection rate during the winter of 1939-1940 in a control ward of the Infants' Hospital of Boston was 12.5 per cent, but in a ward in which the conditions were entirely comparable except that each cubicle was protected across the front and across the top by ultraviolet radiation the cross infection rate was 2.7 per cent. Sommer

and Stokes<sup>6</sup> found that ultraviolet radiation was effective in reducing the number of air borne organisms in a hospital ward.

Recently Henle and his associates<sup>7</sup> prevented air borne infection in white mice exposed in a large hospital ward subdivided into sixteen separate cubicles by using ultraviolet radiation or sprays of propylene glycol. Groups of animals were placed in some of the locations, while cultures of the hemolytic streptococcus of Lancefield's group C or of the virus of influenza A were atomized in one of the cubicles. Both organisms spread rapidly throughout the air of the ward. Ultraviolet radiation and propylene glycol vapor were compared in their effectiveness as disinfectants of the air. With heavy concentrations of air borne streptococci (more than 3,000 cells per cubic foot of air) most of the control mice died from streptococcic pneumonia and septicemia, while propylene glycol vapor protected them completely and ultraviolet radiation failed to prevent death only in the cubicle containing the atomizer. With low concentrations of the streptococcus (200 to 500 organisms per cubic foot of air) all mice survived and cultures taken from the lungs on the eighth or tenth day failed to reveal the streptococcus. However, it could be shown in other experiments that a carrier state had been induced in the animals exposed under control conditions and not in those protected by ultraviolet barriers. This was demonstrated by inoculation of the virus of influenza A eight to ten days after exposure to the air borne streptococcus. All mice died from influenza, but only those belonging to the control group now showed hemolytic streptococci in cultures taken from the lungs. Ultraviolet radiation and propylene glycol vapor were similarly effective in preventing the air borne infection with the virus of influenza A. These results indicate that both ultraviolet radiation and propylene glycol vapor are effective disinfectants of the air. Their application will depend on the individual problems and the location to be disinfected. — [Reprinted with permission, J. A. M. A. 121:261 (Jan. 23) 1943.]

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## Urgent Announcement From Board of Governors

(Continued from page 168)

generated by a spark gap or a vacuum tube type of oscillator. The term shall include "conventional" or long wave diathermy, short wave diathermy, and ultra short wave diathermy.

(3) "Surgical diathermy unit" means a diathermy unit employing a high frequency electric current which is designed for the performance of surgical procedures by cutting, coagulation or desiccation and which is not adaptable for medical diathermy treatment.

(4) "Fever cabinet" means a cabinet or bag designed to induce fever artificially by radiant or induced heat.

(5) "Infra-red generator" means a heating element with a concave reflector which produces infra-red rays, either from an incandescent bulb, a carbon, or a radiant cone, coil or disc, and which is designed to produce therapeutic effect.

(6) "Galvanic generator" means a generator designed to deliver and apply direct current to the body tissues or to deposit the ions of certain salts in solution into the body tissues.

(7) "Faradic generator" means a generator designed to deliver and apply induced electric current to the body tissues.

(8) "Sinusoidal generator" means a generator designed to deliver and apply sinusoidal current to the body tissues.

(9) "Whirlpool bath" means a container designed to circulate thermally controlled liquids around portions of the body to produce therapeutic effect. The term shall include, but not by way of limitation, arm and leg baths and underwater exercise tanks.

(10) "Paraffin bath" means a device designed to apply heat to the body through the medium of melted paraffin.

(11) "Therapeutic lamp" means any electrical device designed to apply heat to the body which utilizes an incandescent bulb.

(12) "Passive vascular exercise apparatus" means apparatus designed to apply alternating negative and positive pressures to portions of the body, but the term shall not include "iron lungs" nor baldness treatment devices.

(13) "Baldness treatment device" means any device or equipment designed to check or treat baldness by applying alternating negative and positive pressures to the scalp.

(14) "Ultra-violet radiation equipment" means any generator designed to generate ultra-violet spectral energy to produce therapeutic effect. The term shall include both the carbon arc and quartz mercury types of generators. "Major ultra-violet radiation equipment" means equipment having a manufacturer's list price of not less than \$150.

(15) "Electric massager" means any device which is designed to massage the human body and which utilizes an electric motor, electronic tubes, oscillating tubes, or any combination thereof. The term shall include, but not by way of limitation, electric vibrators and reducing machines.

(16) "Bath cabinet" means a cabinet or box designed to enclose the body for the purpose of administering either moist or dry heat.

(17) "Electric baker" means a device designed for local and general application of radiant heat which utilizes a reflector and incandescent light bulbs or electric heating elements, or both.

(18) "Heat applicator" means any device, appliance or equipment which utilizes liquids, air or any other substance or material and which is designed to apply heat to the body for therapeutic purposes, other than medical diathermy units, surgical diathermy units, fever cabinets, infra-red generators, whirlpool baths, paraffin baths, therapeutic lamps, bath cabinets, electric bakers, hot water bottles and chemical bags, and accessories used in connection with such articles.

(19) "Hospital" means any institution named on the list of hospitals listed by the American Medical Association, or any other institution for the care of the sick and disabled which has five or more beds for patients.

(20) "Person" means any individual, partnership, association, business trust, corporation, governmental corporation or agency, or any organized group of persons whether incorporated or not.

(21) "Distributor" means any person who purchases physical therapy equipment solely for the purpose of resale without further fabrication.

(b) *Restrictions on the manufacture of physical therapy equipment.*

(1) No person shall manufacture or continue the manufacture of any physical therapy equipment, except to fill specific purchase orders or contracts for delivery to or for the account of:

(i) The Army or Navy of the United States; or

(ii) Any agency of the United States Government for delivery to or for the account of the government of any country pursuant to the Act of March 11, 1941, entitled, "An Act to Promote the Defense of the United States" (Lend-Lease Act).

(2) The restrictions of subparagraph (1) of this paragraph (b) shall not apply to:

(i) The manufacture of surgical diathermy units, major ultra-violet radiation equipment, electric bakers, passive vascular exercise apparatus and fever cabinets;

(ii) The manufacture of whirlpool baths, provided that no metal is incorporated in their manufacture except in pipes and pipe fittings; or

(iii) The assembly of any physical therapy equipment which is assembled from parts which were finished and ready for assembly on February 15, 1943, provided that such assembly is completed on or before March 15, 1943.

(c) *Restrictions on the delivery of physical therapy equipment.*

(1) No person shall sell or deliver any surgical diathermy unit, whirlpool bath (containing metal in any part other than pipes and pipe fittings), major ultra-violet radiation equipment, electric baker, passive vascular exercise apparatus, or fever cabinet, except to or for the account of:

(i) The Army or Navy of the United States;

(ii) Any agency of the United States Government for delivery to or for the account of the government of any country pursuant to the Act of March 11, 1941, entitled, "An Act to Promote the Defense of the United States" (Lend-Lease Act);

(iii) Any person to whom an export license covering the specific equipment has been issued by the Board of Economic Warfare, provided, however, that delivery shall not be made to any person holding an export license which was issued prior to February 15, 1943, unless such export license has been revalidated by the Board of Economic Warfare after said date;

(iv) Any hospital, or any medical department of an industrial concern which is located on the premises of such concern, for the use of such hospital or medical department; or

(v) Any distributor.

(2) No person shall purchase or accept delivery of any physical therapy equipment if he knows or has reason to believe that the delivery of such physical therapy equipment is prohibited by the terms of subparagraph (1) of this paragraph (c).

(d) *Production and shipping schedules and restrictions thereon.* On or before February 25, 1943, and on or before the fifteenth day of each succeeding calendar month, each manufacturer of physical therapy equipment shall file with the War Production Board in triplicate on Form PD-774, his proposed production and shipping schedule of physical therapy equipment for such period as production and shipping may be planned. Unless the Director General for Operations shall otherwise direct, each production and shipping schedule of physical therapy equipment shall be deemed to be approved as of the first day of the month following the month during which such schedule was required to be filed. Each manufacturer shall produce and ship in accordance with his production and shipping schedule as approved or changed by the Director General for Operations.

(e) *Reports.* All persons affected by this order shall file such reports as may be required from time to time by the War Production Board.

(f) *Records.* All persons affected by this order shall keep and preserve for not less than two years accurate and complete records concerning inventories, production and sales.

(g) *Violations.* Any person who wilfully violates any provision of this order, or who, in connection with this order, wilfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from processing or using, material under priority control and may be deprived of priorities assistance.

(h) *Appeals.* Any appeal from the provision of this order shall be made by filing a letter in triplicate, referring to the particular provision appealed from and stating fully the grounds of the appeal.

(i) *Applicability of priorities regulations.* This order and all transactions affected thereby are subject to all applicable provisions of the priorities regulations of the War Production Board as amended from time to time.

(j) *Correspondence.* Reports to be filed and other communications concerning this order shall be addressed to the War Production Board, Safety and Technical Equipment Division, Washington, D. C., Ref.: L-259.

Issued this fifteenth day of February, 1943.

(Signed) CURTIS E. CALDER.

Director General for Operations.

# MEDICAL NEWS

## More News From Australia

The most recent report of our editor-friend in the antipodes dated Feb. 26, 1943, contains news of steady progress in his physical therapy work with the armed forces. It says: "The physical therapy department of this hospital was moved to larger quarters so that I can now treat thirty-seven patients at one time. There are fifteen cubicles for short wave diathermy and a large gymnasium. The work continues to be exceedingly interesting and the results exceed even the expectations of a propagandist of physical therapy like myself. To be sure the patients are most cooperative and are anxious to get better. It is a pleasure and inspiration to care for them. Three weeks ago we started fever therapy. The cabinet was made here according to specifications and has been most satisfactory. It is possible to raise the patient's temperature to 107 F. in an hour or hour and a half and by means of the humidifier maintain a constant cabinet temperature so as to hold the patient's temperature fairly level. The heating elements are turned off after the patient's temperature reaches 105 F. and are not turned on again throughout the treatment. Thus far we have treated only resistant gonorrheal infections and the results seem to justify the efforts. The brand of gonococcus in these parts seem to enjoy the American Gu. tract and they seem to be a tougher breed than those at home for they are resistant to the ordinary chemotherapy. Since a soldier cannot return to duty until he is cured, the need for fever therapy for these resistant cases was necessary. I shall have more to say about this work after a while."

The readers of the ARCHIVES and the numerous friends of Dr. Walter M. Solomon look forward with keen interest to his further reports and wish him continued success in his earnest and enthusiastic service.

## Council Approval for Physical Therapy Courses

The Council on Medical Education and Hospitals of the American Medical Association has extended its approval for the following courses for physical therapy technicians:

*University of Iowa College of Medicine, Iowa City.* Dr. Wm. D. Paul, Medical Director, six-month course, tuition free. This approval, as with other emergency courses, is granted for the duration of the present emergency.

*Graduate Hospital of the University of Pennsylvania, Philadelphia,* regular twelve-month course.

## Dr. Blech Honored

At a recent meeting of the American Legion, Department of Illinois, our former associate and possessor of our gold key of merit, Dr. Gustavus M. Blech, was taken by surprise by being awarded the Legion's Distinguished Service Citation in recognition of his outstanding patriotic services "rendered the Nation, State and Community." Dr. Blech, who, as a veteran of four campaigns has been the recipient of the highest military decorations and whose medical publications have earned him several honorary degrees from foreign universities, has recently celebrated his seventy-second anniversary and is continuing his practice without interruption. Felicitations, General!

## Dr. Landis Named as Professor of Physiology at Harvard

Dr. Eugene Markley Landis, professor of internal medicine at the University of Virginia Department of Medicine, Charlottesville, has been appointed George Higginson professor of physiology at Harvard Medical School, Boston, filling the vacancy that occurred on the retirement of Dr. Walter B. Cannon, Cambridge. The appointment will be effective July 1. According to the *Harvard Medical Alumni Bulletin*, although Dr. Landis is an internist most of his researches have been essentially physiologic in nature or have concerned basic physiologic principles in medical conditions. In 1926 Dr. Landis graduated at the University of Pennsylvania School of Medicine, Philadelphia, where he was in 1931 associate in medicine and in 1934 assistant professor. He has been professor of medicine at the University of Virginia since 1939. In 1936 he received the John Phillips Memorial Medal of the American College of Physicians. Dr. Landis received the Gold Key Award of the American Congress of Physical Therapy in 1936.

## Kenny Treatment Center Opened in Jersey City

The establishment of a school for training physicians, technicians and nurses in the Kenny method for the treatment of infantile paralysis at the Jersey City Medical Center has been announced. The school opened in February under the co-sponsorship of the New York University and the state chapter of the National Foundation for Infantile Paralysis.

## Dr. Kreuscher Retires as Chief Surgeon of Steel Corporation

Dr. Philip Kreuscher, clinical professor of orthopedic surgery at Loyola University Medical School from 1919 to 1932 and assistant professor of sur-

gery, Northwestern University Medical School since 1932, has retired as chief surgeon of the Chicago District, Carnegie-Illinois Steel Corporation, to devote his entire time to his private interests. He has been succeeded at the steel corporation by Dr. Richard J. Bennett, Jr., who since Jan. 1, 1937, has been associate chief surgeon. Dr. Bennett graduated at Temple University School of Medicine, Philadelphia, in 1927.

### New Editorial Board for Endocrinology

A new editorial board has been announced for *Endocrinology*. Members are Dr. John S. L. Browne, department of medicine, McGill University Faculty of Medicine, Montreal, Canada; Earl T. Engle, Ph.D., department of anatomy, Columbia University College of Physicians and Surgeons, New York; Carl G. Hartman, Ph.D., department of zoology, University of Illinois, Urbana, Ill.; Edward C. Kendall, Sc.D., division of biochemistry, Mayo Clinic, Rochester, Minn.; Fred C. Koch, Ph.D., department of biochemistry, University of Chicago; Dr. Cyril N. H. Long, department of physical chemistry, Yale University School of Medicine, New Haven, Conn., and Dr. Harry B. van Dyke, Squibb Institute for Medical Research, New Brunswick, N. J. The managing editor is Dr. Edwin B. Astwood of the departments of medicine and pharmacology, Harvard Medical School, Boston; the associate managing editor is Edward W. Dempsey, Ph.D., of the department of anatomy of Harvard.

### Analyst for the Lend-Lease Administration

Mr. M. R. Kneiff, executive secretary of the Catholic Hospital Association of the United States and Canada, St. Louis, and a great friend of physical therapy, has been granted a leave of absence by that association to enable him to accept the position of Principal Trade Requirements Analyst for the Lend-Lease Administration. The Rev. Alphonse M. Schwitalla, president of the Catholic Hospital Association, announced that the services of Mr. Kneiff were requested by Mr. Edward R. Stettinius, Jr., administrator of the Office of Lend-Lease Administration.

### California State Gas Officer

Dr. Maurice L. Tainter, professor of pharmacology at Stanford University School of Medicine, San Francisco, has been named state gas officer for California by the state council of defense emergency medical service. Dr. Tainter set up the San Francisco gas treatment and protection services for civilian defense.

### Kenny Course for Physicians at New York University

Through a grant provided by the National Foundation for Infantile Paralysis, courses have been established at New York University on "The Modern Concepts of Poliomyelitis."

A practical course for training physical therapy technicians has already been in progress under the auspices of the School of Education, and beginning March 29th a second course under the auspices of the College of Medicine will be given for physicians. The latter course is designed to cover epidemiologic, pathologic and physiologic aspects of poliomyelitis, together with the diagnosis of the disease and its treatment by chemical, serologic, orthopedic and physical therapeutic means including the Kenny Method.

A series of eight lectures at weekly intervals will be given by visiting lecturers from various medical schools throughout the country, and demonstrations of the various techniques will be given in the hospital.

Additional information can be obtained from the Secretary, New York University College of Medicine, 477 First Avenue, New York City.

### Wilmer Krusen

A long full life devoted to humanitarian and educational work came to an end on February 9, 1943, when Wilmer Krusen, President Emeritus of the Philadelphia College of Pharmacy and Science, passed away at the age of 73 years. Dr. Wilmer Krusen graduated from Jefferson Medical College of Philadelphia in 1893; in 1902 became professor of gynecology and later emeritus professor of gynecology at the Temple University School of Medicine; in 1913 he was elected a trustee, in 1914 vice-president and in 1927 honorary vice-president of the university; director of public health from 1916 to 1920 and again from 1924 to 1928. He served as president of the Philadelphia College of Pharmacy and Science from 1927 to March, 31, 1941, when he retired with the title of president emeritus. Dr. Krusen played an active role in medical, charitable and other public organizations; he was a member of the House of Delegates of the American Medical Association for four years, served as president of the Medical Club of Philadelphia, the Philadelphia Obstetrical Society, the Philadelphia Clinical Association and a member of the Philadelphia Rotary Club; was director of the Philadelphia Chamber of Commerce; a trustee of the Welfare Federation and a member of the board of county prison inspectors; had been director and vice-president of the Public Charities Association of Pennsylvania. In 1916 Dr. Krusen received the honorary degree of doctor of laws from the University of Pittsburgh; the honorary degree of doctor of science was awarded to him by Temple University in 1927 and by Franklin and Marshall Colleges, Lancaster, Pa., in 1933; in 1934 received the honorary degree of master of arts in medicine from the Hahnemann Medical College.

Dr. Wilmer Krusen was the beloved father of our Dr. Frank H. Krusen, Head of the Section of Physical Therapy of the Mayo Clinic, who in his own work and many interests carries on a noble family tradition.



### George Le Roy Brown

We regret to announce the passing of Dr. George Le Roy Brown, 66 years old of Chicago. Dr. Brown, who was a member of the Congress for many years, was a native of Salem, Iowa, and was graduated from the Chicago Homeopathic Medical College in 1899. We extend our sympathy to his family.

take over the editorship of the journal which at that time was published by the Abbott Laboratories. He eventually acquired the monthly and had associated with him several collaborators who either contributed articles on physical therapy or abstracted them, notably from the ARCHIVES. The editorial staff and the officers of the Congress extend to his wife and children their sincere condolence.

### George Burt Lake

It is with profound regret that we chronicle the untimely death of Dr. George B. Lake, Editor of Clinical Medicine, which took place after an operation for hernia on March 2, at the age of sixty-three. Dr. Lake resigned from the regular Army Medical Corps shortly after the first world war to

### Correction

A notation "Aided by a grant from the National Foundation for Infantile Paralysis, Inc.," should have been added to the article "Physiologic Basis for Treatment of Paralyzed Muscle," by H. M. Hines, Ph.D.; J. D. Thomson, Ph.D., and B. Bazere, M.S., which was published in the February issue of the ARCHIVES.

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## Cultivated Relaxation for the Elimination of "Nervous Breakdowns" — Jacobson

(Continued from page 143)

(Jan.) 1931; (g) VII. Imagination, Recollection and Abstract Thinking Involving the Speech Musculature, *Am. J. Physiol.* **97**:200 (Apr.) 1931; (h) Electrophysiology of Mental Activities, *Am. J. Psychol.* **44**:677 (Oct.) 1932.

10. Jacobson, E.: The Physiological Conception and Treatment of Certain Common "Psychoneuroses," *Am. J. Psychiat.* **98**:219 (Sept.) 1941.

11. Jacobson, E.: The Use of Experimental Psychology in the Practice of Medicine, *J. A. M. A.* **77**:342 (July) 1921.

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## Ultraviolet Irradiation of Blood in the Treatment of Escherichia Coli Septicemia — Rebbeck

(Continued from page 167)

despite an occasional acute nasal infection. She has received treatments every three months since that time and is in better general health today than before treatments were started.

Many such startling results have been observed following this therapy. We have every reason to feel that with scientific backing and proper research this type of therapy will prove to be one of the most outstanding achievements in medicine.





## BOOK REVIEWS

**THIS IS MY LIFE.** By *Agnes Hunt*, D.B.E., R.R.C. Drawings by *Georg T. Hartmann*. Foreword by *Morris Bishop*. Pp. 237. Price, \$2.50. New York: G. P. Putnam's Sons, 1942.

This is the autobiography of an English girl of the Victorian era, a daughter of an old family of Shropshire gentry, who became a cripple at the age of ten and who subsequently resolved to relieve a great many other cripples. To carry through this resolution she had to overcome her own physical disability, surmount the opposition against what was considered a bizarre idea of becoming a professional nurse and had to endure the ghastly conditions of nurses' lives and hospital life of that period. But in the end she achieved her sublime purpose, founded the first English hospital for orthopedic cases, won great success in treating crippled soldiers of the First World War and became a close and trusted associate of the great and kindly Sir Robert Jones, one of the pathfinders in orthopedic surgery. The story of all this alone would be interesting in itself, but it becomes doubly absorbing and in many of its chapters hilariously entertaining as it is told against a world background, and relates the tremendous misadventures of Mother, whose size was only equalled by her iron whims and determination. The tale begins with a vivid description of the training of English children in the great country houses of the Victorian period with all its virtues and defects. The strictly enforced nursery rule "not to blab and not to blub" was the determining dramatic event in Agnes Hunt's life, because a neglected blister on her heel ended with a spreading infection and the crippling of her leg. In spite of her invalidism she was carried off by her remarkable mother on a fantastic journey to Australia, where she rode hundreds of miles through the bush. This mother managed oceans, continents, storms, disasters, family perils, domestics, animals with a whirlwind energy. Agnes Hunt makes us laugh at the extremely comic side of some of these events—some of them taking place in our own Utah in 1899—and makes us admire her own strength amidst these physical and mental trials. She shows the merit of her Victorian training by refusing to admit any disability or weakness by accepting the world with courage, modesty and humor. Her reward had come to her through the success of the institution she founded which now lives on as the Robert Jones and Agnes Hunt Orthopedic Hospital. This is a volume which should be of real interest to physicians and nurses in general and to all physical therapists in particular and at the same time give mirth, absorbing information and real inspiration to everyone, young and old.

**WHAT THE CITIZEN SHOULD KNOW ABOUT WARTIME MEDICINE.** By *Joseph R. Darnall*, M.D., Lieut. Colonel, Medical Corps, United States Army and *V. I. Cooper*. Illustrations by *Andre Jandot*. Pp. 237. Price, \$2.50. New York, W. W. Norton & Co., Inc., 1942.

The long experience of the authors, one the Executive Officer of Walter Reed Hospital, the other editor of leading medical journals, has united in an effort to give the layman a readable and authoritative work on medicine at war. The first part of the book explains what has been done to mobilize medicine for the present war, including the setting up of machinery for the medical examination of selectees. It describes fully the organization and function of the medical departments of the Army and Navy behind the theater of military operations as well as in the field medical service in the combat zone. Further chapters discuss the new medical problems presented by air fighting, military psychiatry, military sanitation and hygiene, the control of communicable disease and the immunization of the armed forces against them, the venereal problem in wartime and wartime surgery. The final chapter relates to the medical aspects of demobilization. The information included in this volume will clarify many heretofore erroneous and hazy conceptions of military medicine and reveal the important role that medical science and organization play in time of war. It should be a welcome source of information to every citizen about the vast amount of newer knowledge involved in the medical care of the armed forces at home and abroad and for the same reason, may be read with profit by physicians themselves.

**ORTHOPEDIC NURSING.** By *Carmelita Calderwood*, R.N., Consultant in Orthopedic Nursing, National League of Nursing Education, New York. Published and Distributed by the Joint Orthopedic Nursing Advisory Service of the National Organization for Public Health Nursing and the National League of Nursing Education. Paper. Pp. 64. New York, 1942.

The joint Orthopedic Nursing Advisory Service of the National Organization for Public Health Nursing and the National League of Nursing Education has added a valuable outline of teaching orthopedic nursing. This manual provides the nurse with bedside instruction for orthopedic patients. The best possible nursing care of orthopedic patients is stressed, the recognition and prevention of crippling conditions are discussed and the patients' rehabilitation as to emotional, economic and social complications is emphasized. Although the nurse has pledged herself to aid others, it is encouraging to see some reference to the nurses' own health and efficiency.

Teaching nurses about body mechanics or structural hygiene is commendable. The handbook is clear in its contents, it is well written and, although mainly pedagogic, should be of great value to everyone interested in teaching nurses. It can be highly recommended.

**ORTHOPEDIC CONDITIONS AT BIRTH. NURSING RESPONSIBILITIES.** By *Jessie L. Stevenson, R. N.*, Consultant in Orthopedic Nursing, National Organization for Public Health Nursing, New York. Published and Distributed by the Joint Orthopedic Nursing Advisory Service of the National Organization for Public Health Nursing and the National League of Nursing Education. Paper. Pp. 80. New York, 1943.

This handbook supplies information that has been urgently needed. It emphasizes the nurses' responsibility in the recognition and treatment of the more common pathologies found at birth. Brachial birth palsy, cerebral palsy, congenital deformities of the foot, congenital dislocation of the hip, torticollis and spina bifida are discussed. The etiology, pathology, symptoms and treatment are well presented with special emphasis on the nursing responsibilities. It is encouraging to see the space and intelligent presentation devoted to cerebral palsy. This much-neglected subject has long been a challenge to the medical profession and Miss Stevenson has given us an up-to-date review of what we know and what we can do with cerebral palsy patients.

All the chapters are comprehensive, clear and well written. The references are complete. The only possible criticism is the lack of psychologic approach to congenital pathologies. The social and mental hygiene of the patient, his family and the community is somewhat neglected by all of us. It is a handbook that can be highly recommended not only to nurses but to social service workers, occupational and physical therapy technicians and anyone who comes in contact with congenital pathologies.

**CLINICAL HEMATOLOGY.** By *Maxwell L. Wintrobe, M.D., Ph.D.*, Associate in Medicine, Johns Hopkins University; Associate Physician, Johns Hopkins Hospital, and Physician-in-Charge, Clinic for Nutritional, Gastrointestinal and Hemopoietic Disorders. Cloth. Pp. 792, illustrated with 167 engravings and 7 colored plates. Price, \$10.00. Philadelphia: Lea & Febiger, 1942.

Dr. Wintrobe has given the medical profession a much needed book in the field of Clinical Hematology. It is designed primarily for the physician who wishes to practice scientific medicine but who does not have the facilities of any independent laboratory. Also many patients are not financially able to meet the expense of the oft repeated laboratory examinations so necessary in the proper diagnosis and treatment of the blood dyscrasias. Dr. Wintrobe has presented here a practical and fairly simple outline of laboratory procedures that can be carried out in the office either

by the physician, or his nurse assistant who has had laboratory training.

Dr. Wintrobe stresses the absolute necessity for early and accurate diagnosis in diseases of the blood. Treatment to be effective must be based on a careful differential diagnosis which can only be determined by repeated laboratory examinations. Although this book is complete in all details and contains the newest scientific laboratory procedures, it is presented in a sane and practical manner that eliminates much of the confusion and complexity hitherto associated with hematology. Particular attention is called to the chapter on "Anemia in infancy and childhood," which is presented in an intelligent and forceful manner. Deserving also of special attention is the presentation of leukemia. This book should prove to be a boon to the busy physician who must depend mostly on his own office for his laboratory work.

**FAMILY TREASURES. A STUDY OF THE INHERITANCE OF NORMAL CHARACTERISTICS IN MAN.** By *David D. Whitney, Ph.D.*, Professor of Zoology, University of Nebraska. Cloth. Pp. 293, illustrated. Price, \$3.50. Lancaster, Penna.: Jaques Cattell Press, 1942.

This book serves as delightful reading for leisure time or as a reference for the undergraduate student. The appearance of the book is inviting with its numerous photographs and large, clear print. The author has a simple, graphic style and relates amusing anecdotes from time to time to better illustrate a point.

In the chapter on hair, the author considers the value of hair on various parts of the body and writes, "Someone has suggested that in Northern Europe, where the winters are more or less severe, beards may insulate the face and throat against the low temperatures and winds. In ancient times, before scissors were invented, all warriors wore natural beards. In close battles a warrior would seize the beard of the enemy, draw him closer and stab him with his javelin or dagger, if he were fortunate enough to be the first in the seizure. Later a Roman commander sprang a surprise on the enemy by having all of his warriors cut their beards. When the enemy warriors reached for the beards of the Romans, they grasped nothing for a holdfast, but the Romans seized their beards in one hand, drew them closer, stabbed them to death and won the battle."

The entire book does not consist of anecdote by any means. The author deals seriously with facts and evidence concerning heredity in an effort to destroy superstitious notions commonly held. He begins with a general consideration of the family and inherited characteristics. From the general, he proceeds to the more specific and discusses the individual in so far as variations, traits, genes and changes are concerned. Finally, in great detail and using a separate chapter for each feature or part of the body, the author explains heredity with regard to such factors as formation and structure, color,

pattern and value. For example, in the chapter on the eyes, he considers their color, the distance that they are apart and their size, eyelids, bloodshot eyes and color blindness.

In writing on inherited characteristics, the author not only discusses physical traits, but also temperaments and special abilities. Nor has he failed to include a good, understandable explanation of Mendel's Law. The book undoubtedly will cause dispute. For instance, at one point the author intimates that the tendency to lateral curvatures of the back is inherited. Furthermore, readers will take exception to some of his thoughts on the inheritance of temperament and special abilities.

The photographs, which were mentioned earlier, are excellent and are a good indication of the amount of time and study that Dr. Whitney put into his work. He has included numerous references and suggestions for supplementary reading. The outstanding characteristic of the book is its thoroughness as well as its careful organization. It can be recommended to anyone interested in this field.

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**THE 1942 YEAR BOOK OF GENERAL SURGERY.** Edited by *Evarts A. Graham, A.B., M.D.*, Professor of Surgery, Washington University School of Medicine, Surgeon-in-Chief of the Barnes Hospital and of the Children's Hospital, St. Louis. Cloth. Pp. 848 with 305 illustrations. Price, \$3.00. Chicago: The Year Book Publishers, 1943.

If a medical annual had no other objective than to include under one cover the specialistic literature published during the past year, then the present volume like its predecessors is fully living up to this task. But we have come to look on this particular annual as more than that—the critical selection of real contributions to the field of general surgery, but, of course, the editor can only produce the material. Unfortunately there is very little that goes beyond minor modifications of established technical procedures while some articles could have been omitted without lessening the value of the book. At this time when the utmost economy is exacted of every one and in every undertaking for the greater aim of national victory over arch enemies of civilized peoples including our own nation, publishers have rushed in with all sorts of war monographs containing little more than repetitions of those published in 1917, and all this without waiting to see whether under modern armaments of all kinds the surgical methods will prove effective by actual experience in the field and in the military-naval hospitals in the zones of the rear. This reviewer for one is therefore grateful that Graham has stressed the same complaint about articles, and he deserves credit for having limited the space devoted to military or rather war surgery.

His critical remarks interspersed in the text as editorial comments are always timely and based on experience, thereby enabling the average surgeon to read the concerned articles with better understanding. On the other hand the proofreading could have been more carefully done. Thus we find the word

forcep presumably intended as the singular of forceps, which word is singular. We have seen that in some surgical catalogs issued by manufacturers, but it has no place in a scientific book. The same applies to the juggling of tenses. In reports of an operation when the steps are naturally given in the past tense, it strikes one strangely to see the conditions described in the present tense. One need not be pedantic, but good scholarship presupposes correct grammar and language. Otherwise, as was already alluded to, the annual is splendidly gotten up and a must reference book for surgeons.

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**PERSONALITY AND SEXUALITY OF THE PHYSICALLY HANDICAPPED WOMAN.** By *Carney Landis, Ph.D.*, Associate Professor of Psychology, Columbia University, Principal Research Psychologist, Psychiatric Institute and Hospital, New York; and *M. Majorie Bolles, Ph.D.* Research Fellow, Psychiatric Institute and Hospital, New York. Pp. 171. With tables and scales. Price, \$3.00. New York: Paul B. Hoeber, Inc., 1942.

The authors of this volume studied in four groups of women handicapped by chronic heart disease, spastic paralysis, epilepsy, orthopedic disability, the effects of this handicap on their emotional and psychosexual development. It has been a matter of common observation for centuries that certain personality characteristics are associated with certain diseases such as euphorism with the tuberculous and melancholia with the gastrointestinal and the authors looked for personality characteristics which would distinguish the four groups investigated. But all they could conclude is that any persistent physical handicap resulted in hyposexuality and psychologic immaturity, and those who recover may develop normally. The work was made possible by the Committee for Research in Problems of Sex of the National Research Council. It is hoped that similar studies may develop practical recommendations for mental hygiene and emotional education of the handicapped. The book is well written and should make interesting reading for all those in charge of the care, education and health of the handicapped.

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**FUNDAMENTALS OF PSYCHIATRY.** By *Edward A. Strecker, M.D., Sc.D., F.A.C.P.*, Professor of Psychiatry and Chairman of the Department, Undergraduate School of Medicine, University of Pennsylvania. Pp. 187, illustrated. Price, \$3.00. Philadelphia: J. B. Lippincott Co., 1942.

In an introductory chapter entitled "At This Time," the author writes "Each doctor, whether he is a medical officer or remains in civil life to give medical aid to the noncombatant population, must needs acquire a minimum of psychiatric information and skill." This, in short, is the *raison d'être* for the book. It is designed to enable the student or practitioner to acquire quickly and easily "a workable picture of the field of psychiatry." The contents are the result of the teaching experience of the author and the presentations and diagrams have been used in his classrooms.

The book begins with a brief sketch of the historical background of psychiatry. It proceeds to a consideration of the etiologic factors in mental disease; it touches on physical causes, psychic causes, the emotions and the complexity of etiologic factors. A classification of mental diseases is given in which the author briefly defines various types of psychosis. Later in the book, he goes into greater detail in discussing organic psychosis, toxic psychosis, functional psychosis and psychoneurosis. He follows much the same procedure in his presentation of each particular psychosis. For instance, he begins with a brief general comment on schizophrenia, presents two or three typical cases and enlarges on the characteristics of this disease. He then explains the differential diagnosis of schizophrenia and manic-depressive psychosis. He concludes with a discussion of the treatment indicated.

The examination of the patient occupies one of the more lengthy chapters. Here the author presents techniques of the various stages in examination. One of the concluding chapters deals with the psychiatry of war. On the whole, the author has covered a great deal of territory in spite of the brevity of his presentation. The book is valuable as a handbook of psychiatry for students, general practitioners or anyone who is not a specialist in the field. Its very brevity makes it ideal for rapid reading and its outlines aid in understanding the contents. The book is well written and should meet the need for orientation in this field.

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**HOW TO BE FIT.** By *Robert Kiphuth*, Director of the Gymnasium, Associate Professor of Physical Education, Yale University. Cloth. Pp. 131. Profusely illustrated. Price, \$2.00. New Haven: Yale University Press, 1942.

The author of this little volume, according to John Kieran, who wrote the foreword, has spent twenty-nine years of instructive and constructive service in the Physical Education Department of Yale University.

The book is divided into Part I and Part II of fifteen and five lessons, respectively. The eight exercises composing each lesson are clearly described

and illustrated. Each lesson is designed to last about fifteen minutes and is to be repeated at least five times a week for three weeks before proceeding with the next. The lessons are progressive and are intended to be followed in sequence. Most emphasis is placed on the development of the muscles of the trunk and the establishment of correct body mechanics. There can be no doubt that these objectives will be attained if the lucid directions are faithfully carried out.

The exercises in Part II are more strenuous and difficult than those in Part I and are intended for younger persons and for those who have done most of those in the first part. The exercises are free movements and no apparatus is required. This book is enthusiastically recommended to all who wish to be physically fit and also to those who wish to teach physical fitness to others.

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**THE PSYCHOLOGY OF SUPERVISING THE WORKING WOMAN.** By *Dr. Donald A. Laird*, Industrial Consultant with the Assistance of *Eleanor C. Laird*, Research Librarian. 1st edition. Pp. 194. 19 illustrations. Price, \$1.75. New York: McGraw-Hill Book Co., Inc., 1942.

With the steady increase in the number of women workers in war industry and other fields, some general knowledge of the psychology, strength and fatigue characteristics of the woman worker becomes important in their management and supervision. This book endeavors to point out some of the basic differences for application in the varying specific conditions of each business. Some of the stimulating chapter titles are: "Adjusting Work to Woman's Fatigue Characteristics," "Adjusting Work to Menstrual Phenomena," "Organic Factors Underlying Woman's Emotional Life," "The Problems of Crushes and Jealousies," "A Schedule for Checking Masculine and Feminine Traits." Consideration of these factors should enable employers and work supervisors to make adjustments for women's physical and mental make-up and for striving for a maximum of teamwork and efficiency. The book is enlivened by a number of good illustrations and by an entertaining style.





# PHYSICAL THERAPY ABSTRACTS

## Section of Physical Medicine — Discussion on Gonococcal Arthritis and Rheumatism. G. D. Kersley.

Proc. Roy. Soc. Med. 35:653 (Aug.) 1942.

Rheumatism associated with gonococcal infection has three striking characteristics, the variety of the manifestations, the difference in duration between time of infection and onset of symptoms and its reaction to hyperpyrexia.

What are the criteria for considering a case of rheumatism as gonococcal? Is the man who has rheumatic attacks for years and who gets an acute flare up ten days after a gonococcal urethritis to be classed as G. C. "rheumatism"? Similarly what of the man who has had a past gonococcal infection with or without arthritis who gets an acute flare up of rheumatism coincident with return of a urethral discharge which does not appear to be specific in origin? What of the spondylitic who has, years ago, had gonorrhea (or may have had) and who has only a few pus cells on prostatic massage with no evidence of gonococci? Apart from local treatment by heat, counterirritants, massage and rest, the therapeutic field may be subdivided into chemotherapy and hyperpyrexia. Various preparations of the sulphanilamide group have been used by various technics with some success.

Fever therapy has been used by injecting T. A. B. (10 or more million) intravenously or by the more difficult but far more satisfactory method of hyperthermy. Here the thermolabile characteristic of the gonococcus is utilized, the body being raised to a temperature of 106-107 F. and maintained at that temperature for six to ten hours and two to four sessions are usually required. By this means Hench estimated that 90 per cent of acute cases and 60-80 per cent of chronic cases of gonococcal arthritis are cured. The treatment necessitates, however, expensive apparatus and extreme care and skill if calamities are not to ensue. With care and experience, however, the dangers are not unduly great and are well justified by the results, there being only one death at the Mayo Clinic in giving 2,600 treatments to 620 cases.

The combined treatment of sulphanilamide and hyperthermy is still under trial but the results are promising.

Hench records of 10 patients who yielded to combined sulphanilamide and hyperthermy treatment but who were resistant to both when applied separately. Where possible not more than one type of treatment was started at a time and sufficient time was given to assess its apparent benefit to the patient before anything else was tried. Only when improvement was striking after a particular treatment was a note made to this effect.

Pelvic shortwave was carried out by means of anteroposterior application of glass electrodes.

Ionization was applied using saline. Where the joint was painful and swollen the anode was used as the active electrode in order to obtain its analgesic effect on nerve endings and to employ any osmotic dispersal effect on the effusion. Where the condition was more chronic and there was periarticular thickening, the cathode was used as a counterirritant.

Treatment is discussed and when hyperthermy is not available, pelvic shortwave coupled with local galvanism appears to give the best results. The importance of hyperthermy is borne out by the figures.

## Mecholyl Iontophoresis in Arthritis. Zigmore Harris.

M. Bull. Vet. Admin. 19:182 (Oct.) 1942.

The five essentials to success in chronic arthritis therapy are early diagnosis; diligent treatment, continued over prolonged periods; cooperation of the patients; appreciation that physical therapy promises more than drug administration; and the proper alternation or combination of rest and exercise.

It was anticipated that the patients who had received mecholyl iontophoresis might have recurrences and would return shortly after that treatment, as had been the experience when diathermy alone had been used. But it is quite interesting that since this therapy was instituted (i. e., six months before the preparation of this report, which was written in December, 1941), none of the patients so treated have returned. Two of them wrote that they had received diathermy treatments before, but had not felt such sudden and prolonged relief from it as they had experienced from mecholyl iontophoresis.

The disorders of all (35) patients in the series had been diagnosed arthritis, either of the hypertrophic or atrophic type and this clinical diagnosis had been corroborated by roentgenographic examination and later observations. The patients were of the older age group, 40 to 55, and practically all had the hypertrophic form of the disease.

Iontophoresis was usually begun with the use of a 10 milliamperere galvanic current, increased to 20. But this average milliamperage was reduced at times when patients complained of increased heat and pricking sensations, and as low as 6 milliamperes had been employed. The duration of the treatment was, at first, ten minutes; but this was gradually raised to twenty minutes. The number of treatments, once daily, of the individual patients varied from 2 to 57, depending on the respective periods of hospital residence. Except for occasional administration of acetyl-

salicylic acid tablets, no other remedies were associated with the mecholyl iontophoresis. Before applying the electrodes a layer of ointment was placed over the area to be treated, which was then covered with the usual asbestos pad moistened with water. The positive electrode was placed over the area to be treated and the negative electrode served as the dispersive one. There is some economy in the use of an ointment rather than a solution, in avoidance of the necessity of moistening the asbestos pad with a solution.

Of the 35 patients treated, good results were obtained in 18, or 51.4 per cent; fair results in 11, or 31.4 per cent, and poor results in 6, or 17.2 per cent. This gives a total of 29 patients (or 84.8 per cent) who were benefited.

**Progress in Internal Medicine. Vascular Diseases. (Eighth Annual Review.)** George W. Scupham; Geza de Takats; Theodore R. Van Dellen, and Philip L. Marcus.

Arch. Int. Med. 70:444 (Sept.) 1942.

Horton, Krusen, and Sheard studied the effect of various mechanical devices currently used in the treatment of peripheral vascular diseases on the surface temperatures of the toes. Normal subjects, as well as patients with peripheral vascular diseases, were used in their experiments. From their results they concluded that neither the pavaex machine nor apparatus for intermittent venous occlusion is capable of promoting increased blood flow in normal extremities or of value in treating persons with peripheral vascular disease. The best results were obtained by the use of an oscillating bed, provided that this is used in an environmental temperature of 85 to 87 F. (29.5 to 30.5 C.), at which level vasospasm ceases to exist. It must be remembered that this evaluation depended solely on the assumption that surface temperature is an index of blood supply.

A similar evaluation of the usefulness of various physical measures in the treatment of peripheral vascular diseases was presented by Wright. Practically all of the therapeutic agents employed at present are mentioned with particular emphasis on their indications and contraindications. No specific data are given on the results obtained, but favorable comment is made on agents producing heat, active vascular exercises, the oscillating bed and iontophoresis employing acetyl-beta-methylcholine. Wright was not convinced of the value of intermittent venous occlusion and, to a lesser degree, the pressure suction boot.

Interest is being aroused on the question of heat versus cold in the treatment of certain types of peripheral vascular diseases. The previously reviewed work by Allen and his associates on the use of refrigeration as a preliminary to amputation in older patients appears to be gaining favor. Its use in younger persons has recently been suggested by Ochsner, especially in those in whom there is interference with the blood supply as a result of trauma. He suggested that the associated vasospasm be controlled by injection of the sympathetic ganglions with procaine hydroch-

loride or alcohol. The question is not entirely one of controlling the associated vasospasm. It is doubtful if blocking the ganglions will prevent the local action of cold on the vessels. The question is, does collateral circulation develop with the correct amount of refrigeration in these patients or does the cold produce an unchanging condition in the extremity in which neither gangrene nor collateral circulation develops? Many of the details of this form of therapy remain obscure, and consequently more investigation is needed before adoption.

Stein and Weinstein studied the effect of carbon dioxide baths on the peripheral circulation. European authors previously demonstrated that carbon dioxide diffuses through the dermal layers, thus coming into contact with the network of small blood vessels and causing them to dilate. The resultant hyperemia is usually localized to the contact area and is unaccompanied by an appreciable rise in tissue or general metabolism. The authors studied a series of patients submitted to these baths. In all of the subjects the cutaneous temperature increased during the treatment and decreased gradually afterward. When tap water was submitted, the results were similar except that the temperature of the skin fell more rapidly after the completion of the treatment. Capillary studies and blood flow measurements were also made. Blood flow was increased, and in the capillary studies an extraordinarily large number of capillary tufts and loops became visible after exposure. The authors suggest the clinical application of this process but do not report any of their results. One wonders if this is an attempt to resurrect the spa treatments of continental Europe.

Fatherree and Hurst report their observations at Soap Lake, Wash., recently popularized as a spa beneficial to patients with thromboangiitis obliterans. A statistical analysis of 32 patients was made, including not only the usual data but the progress of the disease before and during residence in this area.

**Gastric Atrophy in Far Advanced Pulmonary Tuberculosis Complicated by Intestinal Tuberculosis.** Leo L. Hardt; Morris Weissman, and John S. Coulter.

Am. J. Digest. Dis. 9:404 (Dec.) 1942.

In the course of routine study and treatment of nine hundred fifty-eight cases of intestinal tuberculosis of varying severity for the past eight years, it was noted that some of the cases presented exclusively or predominantly gastric manifestations rather than the standard intestinal symptoms.

There has been very little work done gastroscopically in patients suffering from pulmonary tuberculosis. A study was made of the changes in the gastric mucosa in one hundred nineteen cases of pulmonary tuberculosis with gastrointestinal symptoms selected from a group of two hundred and fifty of the cases which had been gastroscopied.



Of this studied group—fifty-six, or 47.2 per cent were gastroscopically normal, while the remaining sixty-three, or 52.8 per cent showed definite atrophic changes. An attempt was made to correlate the gastroscopic findings with the pathological findings, both gross and microscopic, to evaluate the symptomatology and laboratory data and to give a preliminary report on the effect of short wave diathermy in the treatment of the atrophic changes observed.

In spite of the fact that all these patients were on a high vitamin smooth diet, reinforced with Brewer's Yeast Tablets, 20,000 units of Vitamin A, 400 units of Vitamin D in the form of irradiated milk or 2,000 units of Vitamin D concentrate, 52.8 per cent showed varying stages of gastric atrophy. Frequently high temperatures and sweating are common occurrences in this group of cases. It was pointed out by one of the authors in a previous communication, that there was an appreciable loss of Vitamin B and C in the sweat. Therefore it would seem that there should be an increase of vitamin intake or a more complete utilization of the vitamins given. Short wave diathermy applied to the abdomen will raise the temperature of the stomach one to two degrees and therefore increase the blood circulation in the stomach. It was believed that by increasing the circulation of the gastro-intestinal tract, its absorbing power would thereby be increased, resulting in a more complete utilization of the vitamins. In this series twenty-five patients were given short wave diathermy by electromagnetic induction to the abdomen for twenty minutes each day. This was continued for a period of six to twelve weeks, when the patients were re-gastroscooped and their symptoms reviewed. In practically every instance there was almost a complete absence of symptoms at the end of six to twelve weeks. Gastroscopically there was a reversal of the picture varying in degree from normal to moderate pre-atrophic stages. Five of the twenty-five either refused to be re-gastroscooped or left the institution and could not be recalled, five had completely returned to normal, five were practically the same as on previous examination, while the remaining ten showed a definite tendency toward reversal to normal.

In conclusion, it is desired to emphasize that (1) atrophic changes in the gastric mucosa is a frequent occurrence in far advanced pulmonary tuberculosis complicated by intestinal tuberculosis; (2) this condition can be diagnosed gastroscopically; (3) the histopathology indicates primary atrophic changes with secondary inflammatory changes; (4) the results of short wave diathermy to the abdomen indicate that it is a valuable adjunct in the treatment of gastric atrophy.

**Value of Orthoptic Fusion Training Exercises in Strabismus and Related Conditions. Mary Jane Fowler.**

Arch. Ophth. 28:507 (Sept.) 1942.

The long-debated question of the value of orthoptic training exercises in strabismus and allied

conditions is still unanswered. The orthoptic clinic of the Albert Merritt Billings Hospital ophthalmic clinic therefore presents a summary of an extended study of 192 cases carried out over a period of twenty months, May, 1938, to January, 1940.

Pure orthoptic ("fusion") training exercises (exclusive of occlusion of one eye, use of glasses and prism and surgical procedures on the eye) undertaken and carried out in 182 cases of strabismus (161 of convergent and 21 of divergent strabismus) under thoroughly favorable conditions as to length of observation and number of visits, co-operation of parents, equipment of the clinic and daily time devoted to the work by a trained ophthalmologist were a failure in 180 cases and therefore practically a complete failure. Two patients with divergent strabismus were benefited.

The attempt to develop the faculty of fusion was likewise unsuccessful in every one of 94 cases of strabismus with abnormal retinal correspondence (4 of accommodative convergent, 81 of non-accommodative convergent and 9 of divergent strabismus). Fusion training (carried out consistently and thoroughly) therefore failed in 162 of a possible 182 cases, or 88 per cent.

**Hyperpiesia. A. H. Douthwaite.**

Guy's Hospital Gazette 56:1410 (Aug. 8) 1942.

By hyperpiesia is understood to be a disease characterized by a raised blood pressure and by no symptoms or other sign in its early stages. The diagnosis rests on a single sign for, with the exception of a raised arterial pressure, no other evidence of disease may be forthcoming for many months or even two or three years.

In the absence of symptoms treatment should be almost entirely limited to advice about the general management of the patient's life. It is clearly advisable that he should avoid strenuous exercise, hurry, exposure to severe cold and excessive smoking. If there be pronounced obesity it is wise to reduce this by dietetic measures, not because this is likely to cause an appreciable reduction of blood pressure—although this may occur—but in order to relieve the heart of unnecessary work. The other is the arising of flatulent dyspepsia. In the latter case the avoidance of root vegetables, salads, fatty foods and the drinking of fluid with meals is, as a rule, helpful. There is certainly no evidence that the exclusion of meat from the diet has any beneficial effect, although it is quite the commonest advice which is given. The author sees no point in disallowing alcohol, provided it is taken in moderate quantities and provided that it does not cause unpleasant flushing of the head and face, which may, in fact, be pronounced when hyperpiesia is present. Purging is to be condemned; on the other hand, the danger of straining at stool must be avoided by the use, if necessary, of a lubricant. Perhaps the most important treatment is to refuse to tell the patient the height of his blood pressure. You will find that many of them have already been told these figures and will live in fear of imminent

dissolution should the systolic pressure rise a few millimeters on the previous level. For the anxious patients who insist on knowing the readings and who had already been encouraged in this practice, it is well to explain that the height of the pressure is of minor importance and that the condition of the heart and vessels is really all that matters. It also helps to divert them from their object by asking if they are interested in the systolic or diastolic pressures.

For those who suffer from symptoms, especially from shortness of breath, it is a sound scheme to advise a rest in bed on one day a week.

The excitable, nervous hyperpictic should be treated with phenobarbitone;  $\frac{1}{2}$  gr. twice daily, is usually enough.

The menopausal, obese type may respond well to small doses of thyroid—e. g.,  $\frac{1}{2}$  gr., thrice daily. In addition to bleeding, the giving of digitalis is useful when shortness of breath is present and possibly some edema of the ankles.

Treatment by means of inductothermy is generally temporarily successful. The current is passed through the trunk and each sitting lasts for about half an hour, followed by an hour's rest. It should be given two or three times a week or at least eight occasions. Vasodilatation and slight pyrexia are produced thereby. The benefit lasts seldom more than two to three months.

**Studies on Air-Borne Infection in a Hospital Ward. I. The Effect of Ultraviolet Light on Cross-Infection in an Infants' Ward. Harriet E. Sommer, and Joseph Stokes.**

J. Pediat. 21:569 (Nov.) 1942.

Two almost identical wings of the Infants' Ward of The Children's Hospital of Philadelphia were chosen for the experiment. These were divided into cubicles which were enclosed on three sides by partitions extending seven feet from the floor to within four feet of the ceiling. The design of the ultraviolet installations above the entrance to the cubicles of the west wing was similar to that found at The Cradle in Evanston, Illinois, and later installed in The Children's Hospital of Boston. Individual gown technic was applied by the nurses in all cubicles. Masks were not used for various reasons.

The facts that there were few clinical cross-infections throughout the test period and that the number of pathogenic bacteria recovered from the air of irradiated and nonirradiated wards were so similar pointed to the possibility of an exchange of air between the two wards through the open corridor. This was substantiated by air samples. Since the experimental and control wards at The Children's Hospital of Boston also are connected by an open corridor, this might be a factor toward possibly explaining the discrepancies between the findings of del Mundo and McKhann and those of Brooks in the following year.

It was found impossible, moreover, to study the respiratory organisms of the staff and visiting physicians, of the medical students, or of the few visitors permitted entrance to the wards. Furthermore, children had to be removed from

their cubicles to treatment rooms, x-ray department, and other localities. Differences in susceptibility and exposure are important variables. All these factors tend to make the interpretation of such studies difficult. Finally, the amount of effort, time, and cost involved were considerably greater than the returns warranted.

For future study of the problem, it is considered highly desirable to divide the approach so as to study one mode of air-borne infection at a time in order to obtain basic understanding of the routes involved. This knowledge may then be used to interpret the findings from more complex situations. Animal studies with known organisms would do much to simplify the investigation and permit controlled experiments.

**Studies on Air-Borne Infection in a Hospital Ward. II. Effects of Ultraviolet Irradiation and Propylene Glycol Vaporization Upon the Prevention of Experimental Air-Borne Infection of Mice by Droplet Nuclei. Werner Henle; Harriet E. Sommer, and Joseph Stokes.**

J. Pediat. 21:577 (Nov.) 1942.

In a preceding communication results were presented of a study comparing air-borne hospital infections among infants on a ward protected by ultraviolet irradiation and on a similar control ward. Although in this case, as in some others, ultraviolet irradiation appeared to reduce the incidence of hospital-acquired air-borne infections, many factors tend to interfere with the correct interpretation of the results, such as differences in individual exposure, susceptibility, and response of infants. Tracing of the responsible organisms through the air will frequently fail, and other routes of infection may not be excluded. Furthermore, the number of clinical and bacteriologic hospital infections of the respiratory tract was small, partly due to the success of the sulfonamides in early elimination of foci of infection.

General Electric eighteen-inch germicidal lamps served as the source of ultraviolet irradiation. They were installed in such a manner that three curtains of ultraviolet light were formed, one covering the open front of the cubicle and two spread horizontally over the cubicle and corridor. The efficiency of the lamps was checked at frequent intervals and replacements made when necessary.

Experiments were reported on the prevention of air-borne infection in white mice, conducted in a large hospital ward (14,000 cubic feet) subdivided into sixteen separate cubicles. Groups of animals were placed in some of the locations, while cultures of the hemolytic streptococcus of Lancefield's Group C or of the virus of influenza A were atomized in one of the cubicles. Both organisms spread rapidly throughout the air of the ward. Ultraviolet irradiation and propylene glycol vapor were compared in their effectiveness as disinfectants of the air.

With heavy concentrations of air-borne streptococci (more than 3,000 cells per cubic foot of air) most of the control mice died from streptococcal pneumonia and septicemia, while propylene glycol vapor protected them completely and ultra-

violet irradiation failed to prevent death only in the cubicle containing the atomizer.

With low concentrations of the streptococcus (200 to 500 organisms per cubic foot of air), all mice survived and cultures taken from the lungs on the eighth or tenth day failed to reveal the streptococcus. However, it could be shown in other experiments that a carrier state had been induced in the animals exposed under control conditions, and not in those protected by ultraviolet light barriers. This was demonstrated by inoculation of the virus of influenza A eight to ten days after exposure to the air-borne streptococcus. All mice died from influenza, but only those belonging to the control group now showed hemolytic streptococci in cultures taken from the lungs. Instillation of sterile broth only occasionally activated the streptococcus in the carrier.

Ultraviolet irradiation and propylene glycol vapor were similarly effective in preventing the air-borne infection with the virus of influenza A. While all control mice succumbed to the disease, propylene glycol vapor protected the animals completely against death and only a few lesions were noted in animals from the cubicle containing the atomizer. More lesions and several deaths were observed in the same cubicle when the air was irradiated by ultraviolet lights, and pulmonary involvement was noted also in other locations close to the atomizer, under the same conditions.

These results indicate that both ultraviolet light and propylene glycol vapor are effective disinfectants of the air. Their application will depend upon the individual problems and the location to be disinfected. It must be re-emphasized that only infection by droplet nuclei has been studied. Flüge droplet and possibly dust-borne infections may require different means of control.

#### **The Effect of Ultraviolet Irradiation on *Trichinella Spiralis*. Daniel Stowens.**

Am. J. Hygiene 36:264 (Nov.) 1942.

The precise mechanism of the action of the ultraviolet irradiation is a matter of conjecture, but one possible explanation should receive mention. It is known that ultraviolet light inhibits the action of many enzymes, including those concerned with oxidation and digestion. It seems possible that the death of the *Trichinella* larvae may likewise result from the inactivation of such enzymes.

When the larvae no longer exhibited movement they were considered dead. Those larvae exposed to the ultraviolet irradiation and used for infecting the mice were all motile when fed. Evidently, then, motility is not a true measure of infectivity for these larvae failed to produce infection despite their capacity for movement. Collier after exposing *Trypanosoma brucei* to ultraviolet waves for 30 seconds, found that they lost their ability to infect, although they retained their capacity for movement.

A statement concerning the discrepancy between the results of the intestinal and muscle studies is necessary. Some reduction in the larvae

recovered from the muscles of mice which were fed irradiated larvae was expected, for a smaller number of these exposed larvae reached maturity. The actual number of larvae recovered from the muscles was 50 per cent less than the number which should have resulted if all the larvae which were fed and which attained maturity had reproduced as prolifically as the controls. This may imply that certain other changes resulted from the irradiation which in some manner impaired the reproductivity of the adult worms. A similar observation has recently been reported after *Trichinella* larvae are exposed to roentgen rays.

#### **Occupational Therapy. Elizabeth Casson.**

Practitioner 149:800 (Aug.) 1942.

Ancillary services fall naturally into two groups; first, those processes in which the patient is passive and submits to various forms of treatment—to operation by a surgeon, to being washed and fed by nurses, to receiving massages, passive movement, or electrical stimulation; and, secondly, the part the patient plays in his own cure, stimulated and guided as the medical officer may direct.

The whole of occupational therapy rests on the fact that the patient occupies himself. It is a form of "behaviour," and therefore it is a muscular expression of emotions that arise from stimuli to the patient's mind. If well occupied, the patient's recovery is naturally much quicker than it would otherwise be.

In thus dividing treatment into active and passive, it is evident that a sharp division cannot be made. Even in nursing, the patient is often given what is really a stimulus to his activity. He is told to "just roll over a bit," or "now press your feet on the bed while we lift you"; but this activity is primarily directed to helping the nursing, not scientifically chosen for the patient's advancement.

War conditions are emphasizing the surgical aspects of occupational therapy, and it is therefore becoming better organized than in the case of medical illness. The routine practice is to prescribe it with strict instructions as to what movements are to be undertaken. It is for the occupational therapist to provide the crafts, joinery, or games that are needed. To get the best results certain conditions must never be forgotten. The patient must want to occupy himself; therefore the occupational therapist must be capable of stimulating the patient's interest. It is as necessary to arouse enough emotion to provide a motive as it is to put petrol into the tank of a motor, and the occupational therapist must know how to arouse that emotion. She must know enough psychology (that is, the knowledge of how human beings behave) to be able to judge how any individual will respond.

When once in the workshop it is most important for work to be graduated until the patient is doing a full day's work. For service patients "physical jerks" will have been ordered, to maintain discipline, but for them and for other patients

gardening and other such employment under the care of the occupational therapy department will be carried out quite willingly with more interest, and therefore for longer hours.

There is a large place for occupational therapy among out-patients. Not only should the curative workshop open its doors daily to all for whom it is prescribed, but patients who come up for daily dressings can be kept from sliding into invalidism by careful stimulation, both for helping recovery of the disability and also for keeping up muscular tone and habit of exercise in other parts of the body. The resident patient passes through the stages of occupational therapy in bed, of crafts and joinery in the curative workshop while still in the hospital, but there are great advantages in having a workshop elsewhere, for this approximates better to "going to work" in the first stage. Such a workshop should be open to any cases of illness or injury living at home for whom attendance is prescribed.

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**Cardiac Efficiency and Prognosis Following Recovery from Acute Coronary Occlusion.**  
**Arthur M. Master, Simon Dack and Harry L. Jaffe.**

J. A. M. A. 120:1271 (Dec. 19) 1942.

The authors in this article reach the following conclusions:

1. Cardiac efficiency was studied by various function tests performed serially on 202 patients, who were observed for two to eight years following recovery from acute coronary occlusion. The results were evaluated from a prognostic point of view.

2. Recovery from acute coronary occlusion was found to be good or complete in over one-third of the patients; i. e., they had no symptoms of diminished cardiac reserve or routine activity. One-half were able to return to work, usually full time, and cardiac reserve, as measured by function tests, was normal or only slightly abnormal.

3. A persistent reduction in vital capacity was rare in the good recovery group but common in those whose recovery was poor. However, the vital capacity not infrequently was normal in the presence of severe angina pectoris. A reduction below 2,000 cc. was generally found only among patients who were in congestive heart failure.

4. The two step exercise tolerance test, a simple nonstrenuous test of cardiac function, became normal in 18 per cent and remained distinctly abnormal in two-thirds of the patients. Return to normal usually occurred one or two years after the attack and was associated with a good clinical recovery and decreased incidence of subsequent attacks.

5. The teleroentgenogram revealed definite cardiac enlargement in half of the patients, and the majority of these were hypertensive. As a general rule chronic coronary sclerosis or coronary occlusion did not produce cardiac enlargement unless hypertension or heart failure was present. Although a severe degree of coronary disease may exist without cardiac enlargement, clinical recovery was more complete and subsequent attacks were less common when the heart size was normal, emphasizing the relation

between heart size and cardiac function. Cardiac enlargement was always permanent.

6. A systolic expansion of the left ventricle, pathognomonic of previous infarction, was observed fluoroscopically or roentgenkymographically in nearly three fifths of the patients, and localized absence or diminution of pulsation in 25 per cent. With few exceptions these abnormalities were permanent. Although an abnormal ventricular pulsation did not preclude a good recovery from the attack, it was almost universal in those whose recovery was poor. Not infrequently it was the only remaining sign of previous infarction, being observed in the majority of patients whose electrocardiogram returned to normal. The patients with normal pulsations usually recovered completely and rarely sustained another attack.

7. The electrocardiogram returned to normal or almost normal in 21 per cent of the patients, usually within one year after the attack. The great majority of these made a good recovery, as well as those whose T waves became normal although the Q waves persisted. However, the persistence of the findings characteristic of previous infarction, which was observed in almost two-thirds of the patients, was not necessarily a bad prognostic sign. The location of the infarct, i. e. whether anterior or posterior, did not affect the clinical course. However, when infarction of both surfaces had occurred the prognosis was worse.

8. The electrocardiogram after the standard two step exercise revealed signs of coronary insufficiency (depression of RS-T or inversion of T wave) in 5 of 18 patients whose control record was normal and in 24 of 39 patients with abnormal electrocardiograms. A negative test was associated with a good recovery and good cardiac function.

9. The presence of a normal two step exercise tolerance test, normal ventricular pulsation or a normal electrocardiogram following coronary occlusion was usually accompanied by complete clinical recovery. Not only were significant angina pectoris and dyspnea uncommon when the foregoing tests became normal but a subsequent attack of either coronary occlusion or heart failure was rare. In those whose recovery was poor there was nearly always objective evidence of disability.

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**Discussion on Skin Diseases of the Ear. Reginald T. Brain.**

Proc. Roy. Soc. Med. 35:519 (June) 1942.

Infections of the external auditory meatus often produce secondary lesions in the path of the purulent discharge and these lesions are unlikely to resolve until the otitis has cleared up. This is the task of the aural surgeon, and, because of anatomical factors, it is a difficult one, especially when edema closes the meatal orifice.

Principles of dermatologic treatment should be governed by two important facts. The first is that protection from external irritants and infections depends on a dry and intact horny layer and treatment should be designed to maintain it. Pyogenic lesions are often spread by wet dressings or by ointments which retain sweat and exudates.



The second fact of therapeutic importance is that living cells are instantly damaged by water or by grossly hypotonic solutions and this applies to the skin when the protective stratum corneum is missing or its continuity is disrupted by exudation.

Otologists are familiar with methods of ionization and are no doubt aware that although the penetration of ions is slight the surface effect of the solutions employed is greatly intensified. In consequence eczematous lesions are usually aggravated by ionization. Although lesions of the meatus can be treated with local ultraviolet light the greater beneficial effect of the use of general ultraviolet in chronic infections is often unsought. It is not generally realized that a drying source of heat is most comfortable and healing in the treatment of boils and use should be made of infra-red rays, diathermy or roentgen rays. Radium and radon are invaluable agents in the treatment of the senile and actinic keratoses and of the epitheliomata.

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**The Kenny Method of Treatment for Infantile Paralysis.** Wallace H. Cole; John F. Pohl, and Miland E. Knapp.

Arch. Pediat. 49:663 (Oct.) 1942.

For a proper understanding and execution of muscle reeducation by Miss Kenny's technic a knowledge of her classification of muscles is necessary.

Group 1. Muscles that contract within their normal resting length.

Group 2. Muscles that have to be removed from their normal resting length before a suitable contraction can occur to perform their primary action.

Group 3. Muscle group with separate origin and common insertion and multiple action.

Group 4. Muscle groups with dual origin and dual insertion and multiple action.

Group 5. Muscles that stabilize positions obtained by other muscle groups.

The first two are most important groups. The biceps of the arm and the hamstrings belong to the first group and the triceps and quadriceps to the second and one example will show the importance of this classification. The quadriceps, to contract so as to perform its normal action, must first be pulled from its normal resting position by flexion of the knee. Only then can the pull be placed at the insertion of the patellar tendon and the knee extended. The performance of this motion is the primary function of the quadriceps muscle. So-called "setting" of the muscle with the knee extended does not have any place in the Kenny method.

Muscle re-education, then, depends upon the relief of spasm, the teaching of muscle awareness, the combating of incoordination and "alienation," and the retraining of nerve pathways back to the nonfunctioning muscles.

Only two positions are used, the supine and prone and all the anterior muscles are treated be-

fore the patient is turned over to allow the posterior ones to be attended.

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**The Relation Between the Physical Properties of Electric Currents and Their Electronarcotic Action.** A. van Harreveld; Plesset, and C. A. G. Wiersma.

Am. J. Physiol. 137:39 (Aug. 1) 1942.

The effects of electrical currents applied to the brains of dogs with electrodes placed on the temples have been studied. In addition to a type of electronarcosis (en.) which resembles chemical narcosis and was described by Leduc, another unquiet type, characterized by righting reflexes and hyperinesia has been observed. The quiet type has been designated as the narcotic, the unquiet type as the kinetic type of en. Pulse as well as alternating current can produce both types of en. and which type appears is for the most part an individual reaction. The relation between the pulse duration and the pulse strength necessary to produce the same depth of en. has been determined; this relation resembles closely the strength-duration curves of peripheral nerves. Electronarcosis has been produced with a wide variety of frequencies of pulse and alternating current. For alternating current, the relation between the frequency and the current strength necessary to maintain the same depth of en. has been determined; this relation resembles the para-resonance curves obtained for peripheral nerves. The electronarcotic effect of direct current is small as compared with that of pulse or alternating current. It is concluded that en. is due to the stimulating properties of the current applied.

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**Failure With Cryotherapy in the Treatment of Acne Scars.** Herbert M. Friedlander.

Arch. Dermat. & Syph. 46:734 (Nov.) 1942.

Twenty patients were treated by cryocautery for scars that remained after routine treatment of acne. In 13 cases the average number of treatments was thirty-seven. Cryocautery offers nothing in the treatment of acne scarring that cannot be obtained with conventional, less time-consuming and less painful methods.

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**The Action of Extreme Cold on Leukemic Cells of Mice.** Charles Breedis.

J. Exper. Med. 76:221 (Sept. 1) 1942.

Suspensions of leukemic cells of mice from three different strains of leukemia were subjected to rapid or slow freezing and rapid or slow thawing. Suspensions rapidly frozen to 196 C. were in all cases innocuous, whereas those frozen slowly were capable of transmitting leukemia. The infectivity of slowly frozen material varied from an estimated 0.0001 per cent to 1 per cent of that

of fresh material, and this figure probably represents the percentage of surviving leukemic cells. Particles of spleen and lymph node reacted to slow and rapid freezing in the same manner as suspensions prepared from them.

For one of the strains rapid thawing was less injurious than slow thawing; for the other two the rate of thawing seemed to be immaterial.

Infectivity was equally well preserved after freezing to  $-21^{\circ}\text{C}$ . whether freezing occurred spontaneously after supercooling or was initiated near the freezing point by inoculation with ice, or whether thawing was slow or rapid. Suspensions already slowly frozen at temperatures of  $-2^{\circ}\text{C}$ . or lower, whether spontaneously or by inoculation with ice, could no longer be completely inactivated by subsequent rapid cooling to  $-196^{\circ}\text{C}$ . Unfrozen suspensions initially above the freezing point or supercooled to  $-2^{\circ}\text{C}$ . or  $-8^{\circ}\text{C}$ . and then rapidly cooled to  $-196^{\circ}\text{C}$ . were inactivated. This protection action of previous slow freezing was most marked when the initial temperature of the frozen suspension was  $-15^{\circ}\text{C}$ . or lower; when it was  $-2^{\circ}\text{C}$ . protection was barely detected.

These observations indicate that the changes which are peculiar to rapid freezing alone and lead to complete inactivation take place during rapid transition from the liquid to the solid state, in a range of temperature lying between  $-15^{\circ}\text{C}$ . and the freezing point. Temperature measurements carried out in this range showed that suspensions were about equally infectious whether the temperature at their centers dropped from  $0^{\circ}\text{C}$ . to  $-15^{\circ}\text{C}$ . in 30 minutes or in 1 minute; when the drop occurred in 12 seconds or less, the suspensions became innocuous.

#### Practical Points in Connection With Amputations. George Perkins.

Proc. Roy. Soc. Med. 35:711 (Sept.) 1942.

The first postoperative task is the preparation of the stump; the second is the preparation of the patient. After an amputation the muscles of the stump, deprived of their natural function, waste and lose their physiologic connection with the central nervous system. The joint above the amputation is apt to be held flexed and to become fixed in that position. The muscles must be strengthened and used. Rehabilitation is most important. The patients are taught to exercise their stump muscles against the resistance of a weight working over a pulley. In an amputation above the knee particular attention is paid to the hip extensors and the hip adductors; in an amputation below the knee, to the quadriceps. The patient is made to move the joint above the amputation fully in all directions. Massage is not advocated, partly because it irritates the cut nerves, but chiefly from a psychologic standpoint; the patient should learn to do something for himself and not rely on something done for him.

The patient is encouraged to move his stump

voluntarily as soon as possible and not to hold it immobile and inert; the stump should not be propped up on a pillow. As soon as the wound has healed, the patient is sent to the gymnasium where in concert with others he exercises the stump muscles and after the exercise he is shown how to bandage the stump correctly.

The sooner a limb can be fitted the better, since it shortens the time during which the crippled limb is out of motion. It is usually possible to fit an artificial leg in three months from the healing of the wound, and an artificial arm in six weeks. When the patient has at last been fitted with his limb it is the surgeon's task to supervise his first attempts at walking.

#### Observations on the Kenny Treatment of Poliomyelitis. F. H. Krusen.

Proc. Staff Meet., Mayo Clin. 17:449 (Aug. 12) 1942.

The Kenny technic is not universally accepted, partly because as yet it has not been widely presented and partly because it is difficult for the average physician, unless he has had an opportunity to see actual demonstrations over some period of time, to swallow the almost wholly new concept of the pathologic physiology of poliomyelitis which this group has advanced. This concept is not new in its entirety because, for example, Toomey wrote recently that in poliomyelitis, "most of the pain is not cutaneous but in the muscle. Normal muscle tissue is insensible to touch unless touch sends it into some degree of spasm as in cramping." Toomey said that there is an immediate "setting" or hardening of the muscles and that if this "setting" can be prevented or overcome at the outset, it will be unnecessary later to break down adhesions or to use manipulation. It is likely Toomey was groping toward somewhat the same ideas as the Minneapolis group.

The tremendous enthusiasm for the Kenny procedure seems to a large degree warranted, although it appears evident that some of the claims concerning it are too enthusiastic. In the recent literature, the Kenny protagonists have mentioned repeatedly that they have seen "absolutely no deformities" following the use of the procedure. This is misleading, because some of these patients do have flail extremities after the Kenny treatment and some of them walk with a Trendelenburg limp. These are certainly deformities. What the observers meant to say, I believe, is that they have seen absolutely no contractures, malalignments, or spinal curvatures attributable to contractures following this treatment. In this observation, I am willing to concur. I have seen no spinal curvatures in any of the fifty-four cases which have been under the care of Dr. Pohl at the Minneapolis General Hospital for the past two years. This alone indicates a distinct improvement over the usual methods of treatment.